Proceedings of the

TEACHERS' SEMINAR ON PHARMACEUTICAL EDUCATION

August 15 - 21 1954

HELD UNDER THE AUSPICES OF THE AMERICAN ASSOCIATION OF COLLEGES OF PHARMACY

AT

School of Pharmacy

University of Connecticut

Edited by
H. G. HEWITT

The Teachers' Seminars Are Made Possible By The Support Of

The American Foundation for Pharmaceutical Education

1954 — STORRS, CONNECTICUT

Printed by
INGALLS PRINTING CO.
Danielson, Conn.

Foreword

Preparation for the Sixth Annual Teachers' Seminar began at the interim meeting of the American Association of Colleges of Pharmacy Executive Committee held in Chicago on January 22 and 23, 1953. At the meeting it was decided to solicit suggestions for the program from the members. Fifty-four replies were received, with some of these representing the composite reply of an entire faculty. The Committee appointed by Chairman Joseph B. Burt to consider these suggestions consisted of R. A. Deno, Chairman, L. M. Parks and H. G. Hewitt.

When all of these replies were studied it was obvious that the main theme of the 1954 Seminar must be "How To Teach" and "How To Teach More Effectively". Requests for invitations from the member schools were sent out asking for a host for this event and the University of Connecticut was selected as the place for this meeting. At the Salt Lake City Meetings the Seminar Committee was appointed. This Committee consisted of L. E. Blauch, L. M. Parks, A. E. Schwarting, E. A. Swinyard, S. Wilson, L. C. Zopf and H. G. Hewitt as Chairman. The members of this group present at Salt Lake City had three meetings at which time plans were discussed as to the nature of the Seminar program, possible speakers, etc.

The Chairman upon his return to Connecticut started immediate correspondence with the suggested speakers. The final organization meeting was held at Storrs, Connecticut on November 20 and 21, 1954. All members of the Committee were present. After meetings with members of the University of Connecticut School of Education, Extension leaders and other experts, the Committee was in a good position to make final plans for the meeting. One thought was uppermost in the minds of all, namely that this program should differentiate between *how to teach* and *what to teach* which had been the theme of the five previous Seminars. The mornings were to be set aside for lectures and discussions by specialists in their fields of education, while the afternoon would find the group broken into smaller sections characterized by their interests in our main divisions of training: pharmaceutical chemistry, pharmacy, pharmacology, pharmacognosy, pharmacy administration and professional orientation. Here, with the aid of discussion leaders from our own membership, we would discuss the morning topics as they affected pharmacy teaching. Your chairman contacted all speakers suggested by the various people at our meetings and it might be of interest here to report that all of the morning specialists and all but two of the afternoon leaders accepted. This is some kind of a record. During the winter and spring all arrangements were made with the various University officials and everything was in order for the Seminar dates of August 15 thru the 21, 1954.

The vote as to the success of the program should be left to those who attended. I believe the Committee has a right to feel that the event was a success if the large number of "thank-you notes", verbal expressions and the vote of appreciation spread on the record of the A. Ph. A. meeting which followed in Boston, is a criterion.

I should be remiss in my duties if I did not here express my thanks to those who made this event the success it was. First the cooperation of President A. N. Jorgensen of the University of Connecticut in the address of welcome to our group and for his approval in making dormitories and the facilities of the Student Union available to us; to Dean Edward C. Reif, President of the A.A.C.P.. to Max Andrews, Director of the Union, and his staff for their untiring efforts in making us comfortable; to Carlson E. Crane, Assistant Director of the Continuing Education Center and his staff for the supervision of all details of housing in the efforts to make our meeting a success; to my Committees, both local and national, for their complete cooperation in carrying out all assignments, which resulted in bringing this program to a successful close. The final thanks go to Dr. W. Paul Briggs and President Robert L. Swain, officers and other members of the American Foundation for Pharmaceutical Education without whose help the program could not have been realized. Their help for these past six Seminars is deeply appreciated by all who have an interest in the teaching of pharmacy. While we may not always be as vocal as we should in this respect, I am certain that I speak for all who attended when I say "Thank you for the continued support of the Seminars."

We are proud that our attendance of 335 registrants was the largest ever to turn out to a Seminar. Among this number we had over one-third of the Deans of the member colleges, representatives of all but 12 of the accredited institutions and registrants from 3 foreign countries (the Canadian schools had six representatives) and 40 of our states. We also contributed a meeting pattern of morning specialists and afternoon discussion group programs. It has been suggested that this "Connecticut Plan" should serve as a model for future programs.

Finally I should like to offer some explanation on the editing of these proceedings. There were reams of paper consisting of final reports, discussion material from the tape recorders and many outlines, charts, etc. to choose from. What to include and what to delete was not a simple matter. The funds budgeted for publication served to limit selection somewhat. This report carries all of the morning proceedings except the one by Dr. D. D. Durrell of Boston University on "Language in Learning and Teaching". He did not present a formal paper for publication and the tape recorder, while moving, was not registering the talk. Since Dr. Durrell, immediately after our meeting, left on a sabbatical, I could not obtain copy of his presentation. I am very sorry about this. To those who have found copies of examination questions and other outlines omitted, I apologize.

In the final part of this published report I have given considerable space to the discussions on Professional Orientation. This was done because it had been less completely touched on previous Seminars and no special seminar will be dedicated to this in the renewal of the cycle to start in 1955. The problems of Professional Orientation and Graduate Study should be given serious consideration for future meetings.

In closing I wish to thank the American Association of Colleges of Pharmacy for selecting the University of Connecticut as the host school for the Sixth Seminar and to express my personal appreciation for the privilege of serving as your chairman.

May our teaching be better in 1955 *and thereafter because of this meeting.*

H. G. Hewitt

Contents

Audio-Visual Materials, Place in Pharmaceutical Education, C.W.H. Erickson 62

Discussion, Method, R. O. Billett 22

Examination, Essay and Short Answer Questions, R. L. Ebel 46

Examinations, Scoring and Grading, R. L. Ebel.. 51

Faculty, List of Teachers' Seminar vi

Foreword, H. G. Hewitt iii

Laboratory, Methods of Instructing and Directing Students in, G. L. Webster 33

Laboratory, Purpose and Character of Instruction, D. J. Blick 29

Laboratory, Report and Evaluation of Student Achievement, M. W. Green 39

Learning, Memorizing and Rational, M. O. Pella 16

Learning, Nature of, M. O. Pella 12

Learning, Perceptual and Motor, M. O. Pella ... 19

Lecture, Method, R. O. Billett 22

Objectives, Have We Realized, L. E. Blauch 165

Objectives of the Seminar, What Do We Expect To Accomplish, L. E. Blauch 1

Objectives, Nature and Function of Educational P. Roy Brammell 9

Papers, Methods of Presenting Technical, W. H. Weston 65

PHARMACEUTICAL CHEMISTRY

Bibliography on the Teaching of Courses in... 80

Biochemistry Course
Lesson Planning in, W. E. Moore and L. Levin 76

Methods Used In, G. E. Cwalina 77

Outlines In, J. E. Orr 76

Use of Laboratory In, G. E. Cwalina 78

Classroom Discussion, Methods of, P. Smith and G. L. Webster 77

Examinations and Testing in, G. L. Webster .. 79

Laboratory Instruction, Methods of, P. J. Jannke 78

Organic Medicinal Products Course
Aids in 76

Objectives of, P. Smith 75

Outline of 76

Scope of, A. Marcus 75

Teaching Methods in, A. A. Dodge 77

When to give 75

Visual Aids, Demonstration of Use of, Wei-Chin Liu 77

PHARMACOGNOSY

Course Planning In, H. Hoch 125

Examination Questions, Essay and Short Answer In, M. R. Gibson 138

Laboratory, Methods of Demonstration and Instruction In, H. W. Youngken, Jr. 129

Language in Learning and Teaching, R. A. Deno 127

Learning, Rational, In, L. D. Hiner 127

Lesson Planning In, W. R. Byrum 125

Objectives of Course In, W. R. Brewer 124

Teaching Methods in,
I. The Area of Carbohydrates, R. W. Vander Wyck 130

II. The Area of Glycosides, F. L. Mercer 131

III. The Area of Alkaloid Drugs, H. W. Youngken, Jr. 133

IV. The Antibiotic Drugs, H. E. Bailey 135

Testing, Some Observations in the Field, E. P. Claus 136

PHARMACOLOGY

Aims and Objectives of My Course in, F. T. Maher 96

Course Plans, How I Develop Them in, L. D. Edwards 101

Examinations, Examples of and How I Construct Them in, M. J. Rodman 112

Laboratory, How I Conduct, in, M. J. Rodman 112

Laboratory, How I Plan and Organize in, L. D. Edwards 105

Lecture, How I Develop and Present in, F. T. Maher 97

Progress of Students, How I Evaluate in, G. C. Gross 120

Quiz or Discussion Sections, How I Effectively Use in, G. C. Gross 117

PHARMACY

Calculations, Pharmaceutical, J. B. Sprowls .. 84

Challenge For All Teachers of, L. F. Tice 83

Dispensing, Some Observations on the Teaching of, D. C. Brodie 89

Pharmaceutical Preparations and Technology Courses, Objectives for 86

Physical, L. C. Zopf 88

Teacher, The Pharmacy, L. C. Zopf 82

PHARMACY ADMINISTRATION

Accounting, Course in 144

Averages, How Weighted in Professional Schools, J. H. Goodness 146

Classroom Instruction in, C. G. Rabe 144

Course, Outlines of, ... 144

Demonstration and Laboratory Instruction, Methods of, W. S. Apple 144

Introductory Remarks, C. G. Rabe 143

Laboratory, Demonstration and Administration in, W. S. Apple 144

Outside Speakers, In 144

Teacher in, J. H. Goodness 141

Testing in, P. C. Olsen 145

PROFESSIONAL ORIENTATION

Book Report in History of Pharmacy 160

Challenge for All Teachers of Pharmacy, L. F. Tice 83

Courses in Orientation

Butler University, K. L. Kaufman 155

University of Michigan, T. D. Rowe 151

University of Oklahoma, R. W. Clark 156

University of Toronto, E. R. Paterson 158

University of Wisconsin, G. Sonnedecker 155

Ethical and Professional Relations 161

History and Ethics, K. L. Kaufman 161

History of Pharmacy—Introductory Remarks to Discussion 157

Introductory Pharmacy at the University of Michigan, T. D. Rowe 151

Introductory Remarks, G. Sonnedecker 150

Orientation and Ethics for Pharmacy Students, R. W. Clark 162

Pharmaceutical History and Literature, E. R. Paterson 158

Professional Communications 157

We Explore the History of Pharmacy 158

Program. Teachers' Seminar on Pharmaceutical Education 172

Quiz, Method, R. O. Billett 22

Recitation, Method, R. O. Billett 22

Registrants and Participants, List of 168

Seminar, Summary and Review of, L. E. Blauch .. 165

Teacher, The Evaluation of, R. A. Deno 55

Teacher, Work of the, L. E. Blauch 5

Testing, Purposes and Values of, R. L. Ebel 44

FACULTY FOR TEACHERS' SEMINAR ON PHARMACEUTICAL EDUCATION

APPLE, W. S., Instructor in Pharmacy Administration, University of Wisconsin

BILLETT, R. O., Professor of Education, School of Education, Boston University

BLAUCH, L. E., Chief for Education in the Health Professions. Office of Education, U.S. Department of Health, Education and Welfare

BLICK, D. J., Assistant Professor of Education, School of Education, University of Connecticut

BRAMMELL, P. R., Dean of the School of Education, University of Connecticut

BRIGGS, W. P., Secretary of the American Foundation for Pharmaceutical Education

BRODIE, D. C., Professor of Pharmacy, College of Pharmacy, University of California

BUSSE, L. W., Professor of Pharmacy, School of Pharmacy, University of Wisconsin

CLAUS, E. P., Professor of Pharmacognosy, School of Pharmacy, University of Pittsburgh

CLARK, R. W., Dean and Professor of Pharmacy, College of Pharmacy, University of Oklahoma

CWALINA, G. E., Associate Professor of Pharmaceutical Chemistry, School of Pharmacy, Purdue University

DENO, R. A., Professor of Pharmacognosy, School of Pharmacy, University of Michigan

DURRELL, D. D., Professor of Education, School of Education, Boston University

EBEL, R. L., Director University Examinations Service, University of Iowa

*EDWARDS, L.D., Professor of Pharmacology, School of Pharmacy, Purdue University

ERICKSON, C. W. H., Director Audio-Visual Aids Center, University of Connecticut

FENNEY, N. W., Professor of Pharmacy, School of Pharmacy, University of Connecticut

GREEN, M. W., Director of Educational Relations, American Council on Pharmaceutical Education

GOODNESS, J. H., Associate Professor of Economics and Business Administration, Massachusetts College of Pharmacy

GROSS, G. C., Professor of Pharmacology, Division of Pharmacy, South Dakota State College

HEWITT, H. G., Dean and Professor of Chemistry, School of Pharmacy, University of Connecticut

HINER, L. D., Dean and Professor of Pharmacognosy, College of Pharmacy, University of Utah

JANNKE, P. J., Professor of Chemistry, University of Connecticut

JORGENSEN, A. N., President of the University of Connecticut

KAUFMAN, K. L., Dean and Professor of Pharmacy, College of Pharmacy, Butler University

MAHER, F. T., Section of Biochemistry, Mayo Clinic

OLSEN, P. C., Lecturer in Accounting and Marketing, College of Pharmacy, Rutgers University and Philadelphia College of Pharmacy and Science

ORR, J. E., Dean and Professor of Pharmaceutical Chemistry, School of Pharmacy, Montana State University

PARKS, L. M., Professor of Pharmaceutical Chemistry, University of Wisconsin

PATERSON, G. R., Faculty of Pharmacy, University of Toronto

PELLA, M. O., Assistant Professor of Education, School of Education, University of Wisconsin

RABE, C. C., Assistant to the Secretary, American Pharmaceutical Association

REIF, E. C., Dean of the School of Pharmacy, University of Pittsburgh

RODMAN, M. J., Assistant Professor of Biological Sciences, College of Pharmacy, Rutgers University

ROWE, T. D., Dean and Professor of Pharmacy, College of Pharmacy, University of Michigan

SCHWARTING, A. E., Professor of Pharmacognosy, School of Pharmacy, University of Connecticut

*Died October 29, 1954.

SKAUEN, D. M., Associate Professor of Pharmacy, University of Connecticut

SONNEDECKER, G. A., Assistant Professor of History of Pharmacy, School of Pharmacy, University of Wisconsin

SPROWLS, J. B., Dean of the School of Pharmacy, Temple University

SWINYARD, E. A., Professor of Pharmacy, University of Utah

THOMS, R. K., Assistant Professor of Pharmacology, University of Connecticut

TICE, L. F., Assistant Dean, Philadelphia College of Pharmacy and Science

WEBSTER, G. L., Professor of Chemistry, College of Pharmacy, University of Illinois

WESTON, W. H., Professor of Biology, Harvard University

WILSON, S., Dean of the College of Pharmacy, Wayne University

YOUNGKEN, H. W., Jr., Professor of Pharmacognosy, University of Washington

ZOPF, L. S., Dean of the College of Pharmacy, University of Iowa

COMMITTEES

A.A.C.P. COMMITTEE ON TEACHERS' SEMINAR

L. E. Blauch

L. M. Parks

A. E. Schwarting

E. A. Swinyard

S. Wilson

L. C. Zopf

H. G. Hewitt, Chairman

LOCAL COMMITTEE ON TEACHERS' SEMINAR

Mr. and Mrs. N. W. Fenney

Mr. and Mrs. H. G. Hewitt

Mr. and Mrs. P. J. Jannke

Mr. and Mrs. A. A. Maier

Mr. and Mrs. A. E. Schwarting

Mr. and Mrs. D. M. Skauen

Mr. and Mrs. R. K. Thoms

Mr. and Mrs. W. R. Williams

OBJECTIVES OF THE SEMINAR
WHAT DO WE EXPECT TO ACCOMPLISH?

By Lloyd E. Blauch
Chief for Education in the Health Professions
Office of Education
U. S. Department of Health, Education, and Welfare

In beginning this paper let me say I am sure that much will be accomplished during the next five days in this seminar. For a long time the deans and teachers of the colleges of pharmacy have desired a seminar that would be devoted principally to learning and teaching. That desire is now to be realized. We have gathered here to consider how as teachers we can perform our functions effectively. Moreover we want to do that as directly and concretely as possible. The program, which is rather extensive, has been carefully planned to achieve that specific purpose. It should make an outstanding contribution to pharmaceutical education.

Origin and Development of the Seminars

In preparing this paper I am reminded of the day when Dr. Edward C. Elliott and I talked over the recommendations which the Pharmaceutical Survey should make concerning the improvement of teaching in the colleges of pharmacy. One of the topics we discussed was the institute or the seminar as a means for accomplishing the purpose. We were able to draw upon two types of experience. *First,* in the field of public education the teachers' institute and the summer school had long been in use as instruments for the improvement of teachers. Thousands of teachers annually attended them, much to the advantage of the schools as well as the teachers. *Second,* in the field of engineering education the summer school was employed, beginning in 1927, and it had proved highly successful. The practicality and the proved value of the idea led to the suggestion that it be employed as a means of improving the teaching in colleges of pharmacy. Dr. Elliott forthwith presented a proposal to the American Association of Colleges of Pharmacy and the American Foundation for Pharmaceutical Education. Both the Association and the Foundation adopted it. The seminars got under way in 1949 with one at the University of Wisconsin on the teaching of pharmacy.

"The primary purpose of these seminars" as stated in the report of the Pharmaceutical Survey "is that of providing needed opportunity for the members of the teaching staffs and for graduate students to come into fruitful contact and to keep pace with progressive content and methods of pharmaceutical teaching."

Since 1949 four other seminars for teachers of the pharmacy colleges have been held: On Pharmacy Administration, in 1950 at Ohio State University; on Pharmacology and Related Subjects, in 1951 at Purdue University; on Pharmaceutical Chemistry, in 1952 at the University of Michigan; and on Pharmacognosy, in 1953 at the University of Utah.

It has been my privilege to attend three of the five seminars held in previous years. In my judgment they have been very productive. The colleges of pharmacy are to be congratulated for having adopted the seminar idea and for carrying it forward so well. Moreover, the Foundation is to be heartily commended for supporting the seminars and thus assuring their success.

All this has been by way of a rather lengthy introduction. The committee which planned the program for the seminar has asked me to state what we expect to accomplish. I shall try to speak for the committee. After you have heard this paper, I hope that some of you will present your ideas and indicate additional purposes and objectives which you hope will be achieved.

Principles of Learning

The *first* objective of the seminar is to have the members review and comprehend some of the principles of learning with particular reference to the education of students of pharmacy. As you look over the program you note that a number of papers deal directly and comprehensively with learning. You observe also that other papers necessarily refer to this matter of learning, although perhaps rather incidentally. At any rate, all through the seminar we shall have to keep in mind how our students learn.

Some of us, perhaps most of us, have studied educational psychology — a subject that is often very dull as it is taught. For those who have engaged in such study the papers and discussions may review the subject from a new point of view and provide some insight into its application to pharmaceutical education. For those who have made little or no study of the principles of learning, the papers and discussions should furnish an introduction to a body of knowledge which every college teacher should understand and use.

Fortunately, imaginative and competent workers in the field of psychology are today producing a fund of information that is quite useful in helping teachers understand how to do their work effectively. To be sure, there is much that is not known about learning, for psychology is a new and very difficult science. There is not a little confusion and conflict in its interpretations, but much is known that is of great significance to teachers. We hope that as a result of our week together we shall see more closely some of the principal features of the learning process and their application to pharmaceutical education.

And let me here, for those who will speak to us, emphasize the idea that in presenting their contributions they should keep in mind the practical application to teaching. Mere theoretical and speculative discussions of learning are likely to be a waste of time in this seminar. Unless those who listen are led to see

how the principles of learning relate to their particular work, the papers and discussions will not fulfill the purposes of the program nor prove valuable to our members.

How to Teach

The *second* objective of our meeting is for us individually to increase our knowledge about how to teach. As you look over the program you will see that, while the entire week is given to this subject in some form, two days in particular are devoted to methods of teaching. We expect to have spread before us for our close study the best that is known about college and university instruction. The teacher's technique consists of a great number of skills in all of which he should be proficient. These are to be explained and examined with care in the hope that we shall understand their appropriate uses and see how we can employ them well. Practically all who have gathered here have had experience as teachers. Now we are to have the opportunity, in company with other teachers, to look at ourselves critically, to see our shortcomings, and to learn how we can improve our methods and achieve better results.

One sometimes hears college and university teachers deride methods of teaching as something trivial and unworthy of consideration. This attitude usually results from an erroneous conception of methods of teaching which regards them as "an arbitrary preestablished set of pedagogical rules," as a set of more or less mechanical procedures that have been devised for teachers. Viewed in this way, a knowledge of methods of teaching would be of little value indeed, for good teaching is not done by rule.

I believe we should look upon a "method" as an orderly way of doing something. The word is appropriately used in relation to the performance of any complex act. If the performer proceeds chaotically, he is not said to use a method. It is proper to say that the lawyer has methods for defending his client, the dentist has methods for filling teeth, and the surgeon has methods for performing operations. Likewise the accomplished teacher employs methods of instruction, or orderly procedures, which are intended to produce the right results.

Methods of teaching must, of course, be learned; one is not born with them. As an observer notes a skillful teacher at work, the methods used seem rather obvious and easy to learn, but that is not the case. All expert teachers know that effective procedures can be acquired only through continual study and long trial.

Usually the college and university teacher — the teacher in a college of pharmacy — has been well prepared in his subject; his academic degrees provide reasonable assurance that he has acquired the essential knowledge. However, on the craftsman side he may have had little or no special preparation. Indeed, as our graduate schools operate today, he rarely has the opportunity or time to familiarize himself with the facts and principles that underlie good teaching. This being the case, it becomes necessary that ways and means be provided for him, after he begins his work as a teacher, to help him develop the craftsmanship that will make his teaching effective.

Here then is the central objective of the seminar — to improve the teaching in the colleges of pharmacy through a better understanding of the methods by which good teaching is done and how they can be applied. If next year there is no improvement in our teaching methods, the seminar will have failed to accomplish its principal goal.

Desire to Do Good Teaching

The *third* outcome which we hope will result from this seminar will be an increased desire to do the best teaching we can. I am quite satisfied that no one will be a successful teacher unless he likes the work, fully believes in its worth, and earnestly wants to render a high type of teaching service. William Lyon Phelps, one of Yale's great teachers, typifies this quality. He says in one of his books:

"Speaking only for myself, I will say honestly that with me teaching is more than an art or an occupation. It is a passion. I love to teach as a painter loves to paint, as a singer loves to sing, as a poet loves to write. Before I get out of bed in the morning, I think with ardent delight of my first group of students."

* * * *

"So far from being a dull routine, teaching is to me the most adventurous, the most exciting, the most thrilling of professions. It has its perils, its discouragements, its successes, its delights."

* * * *

"The excitement of teaching comes from the fact that one is teaching a subject one loves to individuals who are worth more than all the money in the world." (Phelps, William Lyon, *The Excitement of Teaching*, p. 69-70, 79, 80; New York: Liveright Publishing Corporation, 1931.)

Many college teachers devote themselves wholeheartedly and enthusiastically to their work, but one suspects from numerous reports that some are satisfied to do less than their best, perhaps because they don't care or don't know how, or perhaps because they have grown weary of well doing. They exhibit no lively interest or ardent zeal for doing the task in which they engage. The net result is a dull, tedious, depressing procedure that fails to inspire students and stimulate them to great achievement. Professors are sometimes characterized as people who talk in other people's sleep. At the bottom of this lack of enthusiasm often lies a lack of appreciation of the great social significance of teaching.

The lack of concern and desire for good teaching results from several circumstances. One is that in many colleges there is little recognition of good teaching. Often the way to advancement is through research or administrative work. Frequently there is little or no check on college teachers to see how well they do their work. It is understandable, therefore, why there is great temptation for the professor to slight his teaching, particularly after he has become well established in an institution. Much of the work is repetitive, grinding over the same grist year after year. It can be very discouraging because great effort on the part of the teacher often yields so little evidence of achievement by his students. Such a combination of circumstances may easily destroy all interest in doing an excellent job.

One way for teachers to overcome their discouragements and frustrations is to attend meetings such as this seminar where they discuss their problems and difficulties and where leaders bring to them new insight and inspiration. The uplift that comes from associating with a large group which is serving society in a significant way and which thoroughly believes in that service can be most stimulating.

Your committee hopes that as we hear the papers and participate in the discussions we shall renew our feeling that teaching is a most honorable occupation — one which we can be proud to share and to which we can dedicate our entire effort. It also hopes that the fine things we shall hear will bring us to the firm resolve to do a superb job as we go about our task of educating pharmacists.

Literature on Pharmaceutical Education

The *fourth* thing we hope to accomplish through this seminar is to increase materially the worthwhile literature on pharmaceutical education, particularly that which deals with the instructional and learning side. The persons whose names appear on the program were asked to prepare and present papers rather than to give extemporaneous addresses. That was done to assure that the speakers would devote ample time to the study of their subject and the formulation of their ideas. Moreover, it was desired to have the ideas committed to paper so they could be studied by us at our leisure and so they could be sent on their way to many of our brother teachers who are not here and to the large number of others who are destined to come after us.

As I look back over the papers presented to the five previous seminars, I find some that are excellent and many that are good. Thus we are developing the educational literature which will prove helpful to all who are concerned with pharmaceutical education. I hope that before too long some master hand will synthesize the best and most useful ideas in a well rounded publication that deals with the educational phases of the profession of pharmacy.

General Education

A *fifth* thing we expect to accomplish through this seminar is to improve our general education. While this objective is different in character from the four already mentioned, no one should take it lightly. We live not only by and for our specialized service; we are a part of a large nation and a wide world. On coming here some, perhaps many, of us have arrived in a strange land. Except as we have studied our geography and read our history, in both of which we may not have had great interest at the time, we may have acquired little familiarity with this particular land and its people. Anyway, here we are in one of the older parts of our country although we call it New England. And we look forward to learning about it.

In preparation for this event I pulled down from the shelf John Gunther's fascinating book, *Inside USA*, to see what he had to say about this part of the world. He writes an interesting description, now a bit dated but still useful. Let me quote from him. He says:

"New England is many things — an area, a precedent, a symbol, and, as so often been said of Boston, a state of mind . . . It is a region of fibrous aristocratic tradition and of a tremendous influx of the foreign-born . . . It is a region of wonderful rivers like the Housatonic, long winters so severe that they warp the character, octogenarian bell hops, a great deal of enormously conservative financial power, and more mildly crazy people than anywhere else in the Nation. It is a region profoundly devoted to specialized skills in small craft industries; but it contains the biggest magazine press in the world, the biggest shoe factory in the world, and the biggest watch factory in the world. It is, as everybody knows, a region with splendid self-reliance on the one side, and a good deal of smugness, bleakness, and provincialism on the other, but it has a greater tolerance for eccentricity than any area in the country."

For those of us who are engaged in educational work New England has a special interest. Here was begun and developed the public school idea as we know it in the United States. Massachusetts gave us Horace Mann and Connecticut gave us Henry Barnard, both of whom are numbered among the great protagonists of the free public schools. Likewise in New England there was established the first institution of higher education in the country. This part of the world has long been known for its great institutions of higher learning, particularly those that are privately controlled and endowed. In later years it has begun to develop State colleges and universities, of which the University of Connecticut is the outstanding example.

No doubt many of you will travel to various points of interest in this land which has given so much to America. Such journeys brush the cobwebs out of our minds, give us new perspective, and provide fresh substance for us to use in thinking anew about our great country and its meaning. The knowledge and points of view so acquired help us in many subtle ways to become better teachers, for we teach not only our specialized subjects of the curriculum but also, and quite as much, an understanding of our civilization, a wholesome outlook on life, and the moral responsibility for honorable behavior in all public and private matters. The successful teacher teaches out of an abundant life. Whatever provides intellectual and spiritual enrichment for him improves, refines, and ennobles his teaching.

Personal Acquaintance

Lastly, a *sixth* objective of this seminar is for us to become better acquainted with one another. I am deeply impressed by the fact that the members of our pharmaceutical faculties are a body of intelligent, likeable and devoted men and women who are working together to improve the health of our people and to make life more enjoyable for everyone. People who join in such an endeavor need to learn more about one another. The bond of interest which unites them provides a foundation for firm and enduring friendships. Friendships so well based are of the greatest significance in strengthening and sustaining people in the arduous tasks of their daily work and the harrassing experiences that at times befall them.

As I prepare for and travel to these seminars I look forward to seeing friends from whom I have learned much and whose companionship has been most enjoyable. And I also look forward to making new

friends who will mean much to me as the years go by. No doubt this has been and is the experience of many of you now present. So I anticipate that we shall find this meeting a source of personal pleasure and mutual satisfaction.

In Conclusion

Such are some of the objectives that, we hope, will be accomplished by the seminar. The program has been organized with the first four in mind. As you looked over it you have probably noted the large number of topics to be considered. Each forenoon will be devoted to a general session at which a group of papers will deal with the theme of the day. The discussion sections in the afternoon will consider the theme in relation to each of the five major fields of the curriculum. You have also noted that two evenings are to be given to workshops on professional orientation — a subject in which there appears to be increasing interest and in which the purposes, content, and methods should be clearly outlined. On another evening we are to be taught by one of the imaginative and respected teachers of science. The committee hopes that the afternoon and evening discussions will be particularly productive.

This should be an inspiring and valuable seminar. Let us work together to make it so.

THE WORK OF THE TEACHER

By Lloyd E. Blauch

Chief for Education in the Health Professions
Office of Education
U. S. Department of Health, Education, and Welfare

It is a distinct pleasure to me to begin the discussions of today with a statement about the work of the teacher. For some years I was a college teacher and from that work I derived great personal satisfaction. Even today I know of no other work in which I would rather be engaged. So I come to you as one who prizes teaching highly as a vocation.

Let me say, at the same time, that I do not pose as an expert in this matter. Indeed, I am rather humble in discussing it for there are so many ideas about teaching. Moreover, I am a little troubled by the fear that you may know as much concerning the subject as I do.

Two Aspects of the Teacher

In his book, *Two Sides to a Teacher's Desk,* Max Marshall says: "Last March I signed myself on the blank of the Collector of Internal Revenue as a bacteriologist rather than as a teacher. This indicates conceit and delusion. Popularly, anyone can teach, provided he is a step ahead of his students. It takes special training to be a bacteriologist; besides, the word has more syllables. But there is something false here. I have two daughters of college age whose reactions to education are most interesting and toward whom the reactions of educators are more so. I have attended hundreds of meetings of committees or faculties and I have talked to several thousands of students. Am I a teacher or a bacteriologist? It is a simple fact that I get at least as excited over an examination or the problem of what to do with a student as over the vagaries of an antibiotic drug. Of the time spent in discussing bacteriology and teaching, as great a proportion of time goes into one as into the other."

Here we have a statement that presents the typical situation of the college or university teacher. In the field of higher and professional education one cannot be a teacher without being a teacher of something — some subject or branch of knowledge. That is, one is both a teacher and a specialist. The college or university teacher therefore is something of a dual personality and he serves his fellowman in a dual capacity.

I refer to this divided interest of the teacher in order to call attention to the unique situation which confronts him. He has two loyalties, at least he should have — one to his subject or field of specialization and the other to his service as a teacher. Let us look at each of these for a moment.

As a specialist in a particular field of learning the college or university teacher has acquired an extensive fund of knowledge of his subject. He has developed certain skills and modes of doing things that come within his field of specialized study, and he has taken on certain ways of thinking. He has learned the language of his subject. He has joined a company of past and present scholars who were and are devoted to one particular aspect of culture and service to mankind. He may have become so deeply immersed in his field of learning that he tends to neglect all other concerns. Indeed, sometimes he does just that, and becomes the despair of his wife and family and his friends. He may not be satisfied with being only a consumer of the contributions derived from his field of study; he may engage in making contributions of his own through original work in the form of research. He must be a scholar who is dedicated to a field of learning, who enjoys his experience in it, and who believes in its value for mankind.

Let us look for a moment at the other side of this dual personality. As a teacher he is concerned with learning — the learning of his students. His principal function as a teacher is to cause others to learn, to inspire, stimulate, encourage, and direct learners to acquire useful skills, worthwhile ideas, sound attitudes, and intellectual power. This function makes many demands on him and requires of him a special competence. Presumably he has devoted considerable time and effort to the observation and study of learning. Moreover he has acquired some skill in facilitating learning and causing others to learn.

It is assumed that he recognizes the earmarks of good teaching; that he possesses a friendly interest in young people and a fruitful understanding of the workings of the human mind; that he has good physical and mental health; that he is mentally alert; that he is well adjusted in his personal living; that he possesses a wholesome affirmative outlook on life, a rational and ardent belief in the worthfulness of life and human effort; and that he is moved by an ethical concern for his fellow men. In short, it is assumed that he has come to think and act like a teacher.

He has joined a noble company — a great company of men and women who are dedicated to the preservation and improvement of our civilization through the humanizing of knowledge and the development of intellectual and moral power in the rising generation.

Perhaps he works at his task with enthusiasm and receives from it intense personal satisfaction as he notes the development of his students and their increasing achievement. He may agree with Professor William Lyon Phelps, an eminent teacher at Yale University, who wrote: "The chief happiness of the teacher is in the influence he exerts on the minds of his pupils, and of the intimate, permanent friendships

that result. It is truly a great profession, one of the most mentally and spiritually rewarding in the whole world. And the teacher's personality is remembered by his pupils all their lives, sometimes with contempt, sometimes with anger, sometimes with amusement — and sometimes with profound respect and gratitude."

The instructor on the college faculty is then two things — a specialist and scholar and a teacher. Happy indeed is he when there is a fine balance of interest and accomplishment between the two. In such a person we should have a good teacher.

After completing this statement I reread the quotation from Max Marshall. I then saw another idea in it. You will remember that the author was about to give an account of his taxes. In that we see a third relationship of the bacteriologist-teacher; he is a member of a community of people to which he owes obligations and loyalties and from which he derives his support as well as many other good things. In short he is a citizen of his local community, his State, and the Nation. The community of people makes his activities possible; his success is definitely linked with their welfare. In everything that the bacteriologist-teacher does, he needs always to be aware of his civic relationships and responsibilities, and as a teacher he is derelict in performing his proper functions if he does not help to make better citizens of his students.

So much by way of introduction.

In the main part of this paper I want to magnify the role of the teacher, with particular reference to the teacher of pharmacy. That I want to do by referring to the great variety of activities in which he engages, by describing briefly the complex character of these activities, and by indicating some of the qualities of mind and heart which help to make him successful.

Establishing the Objectives

For our purpose we need to consider seven different activities and functions of the teacher. The *first* of these is for him to establish the objectives his students are to accomplish. This must be done for each of his courses. Teaching, like any other rational activity, is carried on to achieve certain goals which have been determined in advance. These goals give direction to the activity. They furnish a basis for deciding what subject matter the teacher will use, what methods of teaching he will employ, and what assignments he will make to his students. It is, then, very essential that the teacher formulate the objectives to be attained in his courses. These objectives should be set forth in terms of the desired attainments of his students rather than in terms of topics to be studied, credits to be obtained, or number of exercises to be completed. Moreover they should be explained to his students.

Preparing the Courses

Second, the teacher has to prepare his courses. A well designed plan for a course makes teaching an orderly process, assures the maintenance of perspective and guides the work to the desired conclusion. If the plan is placed in the hands of students it provides for them a view of what they are expected to accomplish and enables them to cooperate understandingly with the teacher. It also enables them to plan their work — and that is most helpful, for they are besieged by numerous demands, some of which are unanticipated.

The preparation of a course involves several steps. After the teacher has clearly formulated the objectives to be accomplished he proceeds to list the topics he will include. Here he may have difficulty for often there is a great abundance of material and only a limited time that can be devoted to a course. This means that he is forced to select from a field the content that will best serve the purposes of the course. He may have to omit topics that are favorites of his in order that the necessary points may have adequate time.

Having decided on the topics to be included the teacher must arrange them in logical sequence and set them to the calendar. Then for each topic he must prepare a list of reading materials, visual aids, and special apparatus and equipment. Perhaps he must find special situations for observation on field trips.

In planning the assignments for students the instructor must guard against overloading his course in relation to the amount of time scheduled for it. Occasionally one finds a teacher who is given to assigning a large amount of what is sometimes called busywork, such as blind routine reading assignments in the library, laboratory exercises that teach nothing new, or other work that merely adds to the burden of the student. Sometimes heavy loads are assigned in order to make a course impressive regardless of whether such loads are educationally justified.

The plan of a course *should* also include plans for tests, which should usually be given at times when there are continuity breaks between topics. The number and types of tests that should be employed depend on a number of factors, but certainly 5 percent of the time may well be used for such exercises. Perhaps 10 percent would be a better figure.

In my judgment the plan of a course should be reproduced and placed in the hands of students. That will save time for both the teacher and the students, it will avoid misunderstandings about assignments; and it will be especially helpful to students who for some reason or other are occasionally absent.

Many college and university teachers find that they have to replan a course everytime they teach it. New knowledge and new points of view must be incorporated. As the teacher's outlook expands he may have to reorganize the plan completely. Then, too, by trying new forms of organization and different methods of teaching, the teacher generates enthusiasm for his work.

Not all teachers, however, follow the practice of replanning their courses. One observer said some years ago: "Many professors, after they have become well established in their respective chairs, fail to develop either themselves or their departments. After they have outlined their courses, prepared their syllabi and their lists of reference works, prepared their lecture notes. etc., they feel that their life work is accomplished. They snooze through the years, ignore the necessity of their own intellectual advancement as well as that of their departments, and become a dead weight on the intellectual and scholarly life of the college." (James M. Todd, ed., *The College Conundrum,* p. 30.)

By way of contrast, the practice of Professor William H. Kilpatrick, a teacher of wide repute, may be mentioned. Among the things that he believed contributed to his success was " . . . hard work at studying out in advance all the details that can be planned in preparation for what is to happen. I spend much time and effort in devising question sheets, preparing bibliographies and the like. I am constantly on the lookout and in consultation with my assistant as to how our plans are working out and how they might be improved for the next time." (Fernandus Payne and Evelyn W. Speith, *An Open Letter to College Teachers,* p. 187.)

I am emphasizing the planning of courses here because this afternoon you will deal with it in your discussion groups. I am emphasizing it also because of its great significance in good teaching. When there is no comprehensive planning of courses the instruction is likely to suffer from unprofitable digressions and dawdling at places, coupled with madly rushing along at others, regardless of educational values. A waste of time and effort, a bewilderment of students, and a failure to achieve the best possible training are the likely result. Instruction without careful planning almost invariably betrays a lack of genuine concern on the part of the teacher for success in his work.

Preparing the Daily Work

Third, the college or university teacher needs to make daily preparation for the sessions with his classes. Few things that he does yield greater returns. The lack of such preparation is a common cause of failure.

The teacher needs to study the subject matter for the purpose of renewing knowledge previously required, clearing up hazy ideas, recapturing the details, and getting the relationships clearly in mind. In his daily study he may also acquire new knowledge and fresh points of view.

Then too the daily preparation includes determining the objective of the particular lesson and selecting or devising the means to be used in realizing the objective. Time may be apportioned to the various parts of the class work. Leading questions, problems, and exercises should be designed. Special attention may be given to relating the lesson with other subjects of the curriculum. If illustrative materials are to be used, they should have particular attention in order to assure that they will be on hand at the appointed time and will operate properly.

Such careful daily preparation is a long step toward success in teaching. It avoids random and haphazard action and makes teaching a systematic and orderly process. It simplifies the work of the teacher in the classroom, for, instead of having to improvise a procedure and carry it out at the same time, he can devote his attention entirely to the execution of the plan and making such adaptations as may be indicated by the situation.

One further word regarding this matter. Careful preparation is characteristic of sensible and intelligent persons in all difficult undertakings. It is particularly needed in teaching where one may so easily do the wrong thing and fail to achieve the results that should rightly be expected. And only one who is willing to make the necessary preparation should have a place in the classroom as a teacher. Only such a one is likely to generate the enthusiasm that will make him an inspiring teacher.

Conducting the Class Session

Fourth, the teacher conducts the meetings of the class. Here his work reaches its culmination — the climax for which he has prepared. It is the supreme test of his resourcefulness and ingenuity. Here, within fifty precious minutes he has an opportunity to achieve great things in the lives of his students.

The first act of a good teacher at the initial meeting of his class usually is to state what it is proposed to accomplish by the course, what subject matter will be used, and what methods of instruction and study will be employed. Such opening explanations serve the same purpose to the intelligent student as a chart does to a sailor. They inform the student, before setting out on his intellectual voyage of discovery, what haven is his goal and by what route he is to reach it.

The college and university teacher may employ a number of methods in his instruction. He may lecture; he may direct various forms of discussion; he may use a question and answer procedure; and he may employ a variety of visual aids and forms of direct experience with objects and situations. As an accomplished teacher he should be competent to use any and all of them as they appear to be the most appropriate means of accomplishing his purposes. Sometimes a formal procedure is best, at other times an informal one produces the best results.

In the classroom the teacher needs to remember that, although a group of students are present, he teaches individuals. Some teachers succeed very well in this, others have difficulty in doing it. A little booklet titled *You and Your Students* issued by the Massachusetts Institute of Technology says very pointedly: "Level your attention . . . at individual students, not to the class as an impersonal body of people. It is the individual student who matters." The teacher meets students simultaneously as a class partly because it is economically impossible to meet them singly and partly because group activity in a class is very stimulating. Nevertheless the learning is done by the individuals, not by the group. The teacher's service is improved as he keeps in mind their abilities, needs, and special difficulties.

Inasmuch as the various methods of teaching will be discussed in several papers tomorrow I need not deal with them further. I want merely to say that, in my judgment, the class meeting should be primarily an exercise in thinking both for the students *and* for the teacher. If it is largely anything else, it is likely to be dull and uninspiring. The final test is to be found in the new understandings the students have reached, the new insights they have acquired. the new horizons they have gained. Have they grasped more fully the nature of their undertaking; have they learned to think more clearly; have they received new inspiration to do their best? — these are among the achievements that should result from the contact between teacher and student in the classroom.

Counseling with Students

The *fifth* function of the teacher is to counsel with students. No teacher's job is properly done merely by meeting his classes. To be sure, a considerable part

of the counseling of students is delegated to particular officials such as deans and faculty advisers, but every college teacher who is genuinely interested in students and respected by them has many occasions to advise students, sometimes in regard to a particular course, and sometimes about other matters of mutual interest. Time spent discussing individual problems with students may often be as important to them as the learning of a particular class assignment. Moreover, these contacts are essential for the teacher who wants to understand his students in order that he may serve them well.

Evaluating the Attainments of Students

The *sixth* part of the teacher's work is to evaluate the attainment of his students. For both the teacher and the student this evaluation has great importance—more, I suspect, than we realize. I am quite satisfied that we teach too much and examine too little. If the results of tests and examinations are carefully studied by the teacher and his class they become a means of considerable enlightenment to students — and likewise to the teacher. Their use tends to emphasize the responsibility of the student for his education.

Often the work of testing and examining is greatly disliked by teachers, and frequently it is not well done. In some respects it is the most difficult function the teacher has to perform. The preparation of good examinations requires a lot of careful, deliberate work. And the proper scoring of the answers and the assignment of grades, particularly when essay-type questions are used, is an exacting and time-consuming process which can be well done only if a great deal of effort is devoted to learning how to do it.

Inasmuch as you will devote one day of this seminar to tests and examinations, I shall not discuss this activity further at this time.

Disciplining Students

The *seventh* aspect of the teacher's work is disciplinary. I hesitate to mention discipline for usually we think of it as belonging to the lower schools. But we cannot overlook it. I have known college teachers who simply could not keep order and whose classes and laboratory groups were often demoralized. The maintenance of order in a college teaching situation usually results from a combination of factors which include certain attributes on the part of the teacher that are more easily felt than described. Often they are personal and subtle. Another aspect to discipline relates to cheating in tests, examinations, and other written work. The prevention of cheating, and the detection and punishment that are necessary where cheating occurs, come within the teacher's responsibilities.

The statements just made about discipline relate primarily to situations under the immediate direction of the teacher. In most institutions his responsibility extends beyond such situations. Recently I came upon an excellent discussion of this matter by Dr. Thomas Brady, a vice president in the University of Missouri. He points out that in that university the teacher is still an officer of the institution outside his class room and laboratory. He says the teacher "has an obligation, as long as the student is enrolled, to act or enable others to act in any situation requiring regulation of the student's conduct." Dr. Brady says also: "This is not to say that each teacher is a policeman — any more than I would say each parent is a policeman. In neither case is the primary intent to punish or vindicate the authority of society. The aim in both cases is to promote the welfare of the people involved and to make them upright, responsible citizens." (Elmer Ellis, *Toward Better Teaching in College,* p. 56.)

I need not discuss this matter further. My intention has been to indicate that discipline is a function of the college teacher which he cannot escape.

Such are, then, seven aspects of the college teacher's work and responsibility. Another which I should like to describe is research, but there is not time for that. Then too there are numerous other types of service which a teacher renders such as serving on committees and representing the institution and his department on various occasions.

In Conclusion

In this paper I have tried to outline briefly the work of the college or university teacher as I see it. This work, if it is done well, makes heavy demands. One of the most impelling of these demands is that the teacher shall keep up to date, that he shall retain a lively interest in new things, that he shall possess a continuing enthusiasm for his work.

Three years ago an inquiry was made concerning the teaching at Brooklyn college. Extensive judgments and opinions were collected from some thousands of students. I shall refer to only one statement in the report. It was: The one finding which protrudes from the statistics with compelling consistency relates to professional age. Older teachers were thought to be more competent from a subject-wise point of view, but in other respects they tended to be judged harshly. This finding should serve as a warning to college and university teachers. Somehow, they will have to retain their vitality if, as they grow older, they wish to have the approbation of their students.

Some years ago, in my youthful enthusiasm, I gave to the dean of a university school a copy of the first book I had written. It was on a subject that I thought would interest him. Much to my chagrin he informed me that he no longer read books! I then saw what I had not noted before — he was on the down grade, not because he would not read my book, but because he had lost interest in learning new things. This dean was quite in contrast with another dean, now retired, who up to his last days of service set aside every Monday evening to read the Journal of the American Medical Association.

I am told on what I consider good authority that the college and university teacher's most grave occupational hazard is the temptation to laziness. The risk that there will be a decreasing working drive, once the teacher is secure in his tenure, is quite real. He is left pretty much to himself. No one can tell him what to do; it would hardly be regarded as cricket for anyone to supervise his work. He proceeds on his own steam. He has a grand opportunity to take life easy. Sometimes the temptation is too great.

At the same time I know of no other occupation which is more exciting and challenging for him who will work at it diligently and with the determination to be a master workman.

THE NATURE AND FUNCTION OF EDUCATIONAL OBJECTIVES

P. Roy Brammell

Dean, School of Education
University of Connecticut

We have had educational objectives as long as we have had education. These objectives have varied in time and place, but they have always existed. They have not always been achieved as desired, but, on the whole, they have given education its bent, which is their rightful purpose.

Educational objectives do not, of course, stand alone. They bear a direct relationship to our basic beliefs about society, politics, ethics, and human nature. Certainly the objectives and techniques of education are not the same in dictatorships and in democracies; they will be different between groups for which standards are already determined and groups in which this determining process is always at work; and they will vary in accordance with our beliefs about human beings — how they learn, the sacredness of their personalities, and what their interrelationships should be.

In ancient Sparta, individuals were useful, not in their own right, but in terms of whether or not they contributed to the ends and purposes of the state, which were largely military. In Athens, something else was added. It was admitted that individuals might make contributions in ways other than through military service. The pursuit of individual interests was permitted. This did not result in a democracy as we know it today. The opportunity to pursue personal interests did not extend to all men. Nevertheless, the lines of having objectives determined and imposed by an authority or of having them evolve and change through the exercise of intelligence were clearly drawn, and the schools of that time reflected these primary differences.

When the Renaissance brought to light the manuscripts of ancient Greece and Rome, one group of people seized upon the manuscripts as patterns of form, "classics", to be studied as documents in the favored languages worthy of emulation. Another group of people was inclined to look beyond the mere acceptance of these manuscripts to their content, seeking to relate the problems revealed in these documents to their own problems in their own times. More important than the attitude of acceptance was the birth of thought and inquiry. Quickly education, religion, government, and even scientific inquiry felt the burden of this fundamental separation. The Protestant revolt, the rise of democratic governments, the beginnings of education based on the nature and needs of individuals, and the whole age of free inquiry and objective research rose as vivid reactions when man began critically to evaluate his own environment. The schools of those times were not able to resolve in their controlling objectives, their curricula, and their teaching procedures, the problem of acceptance versus initiative, the teacher versus the pupil, the prescribed curriculum versus the nature and needs of pupils.

This general problem, so ancient in its origins, is yet so modern. Modern idealism in education, on the whole, holds that the most important and most enduring things in this world are ideas, that certain ideas are ageless, and it is the obligation of the school to see that these verities are transmitted. This is the attitude of acceptance. Whatever writings contain these ideas, will, of course, become important in the school curriculum. Teachers have the obligation to teach that which is considered good. Thus the educational objectives, the curriculum, and the teaching methods are to a degree at least authoritarian, prescriptive, and memoriter. Subjects are important.

Over against modern idealism and charged with the explosive urge to freedom possessed by Americans in general, is the idea that in education people are basically more important than subjects. Here the premium is set on the intelligence of each man and each age to live life anew, to think it anew, to test it always for its current adequacy, always unwilling to discard anything of the old that will make the present and the future better. People are important. They are important not only for what they think, but that they *think*, seriously, mindful that they are a part of a free society and an educational system that are obligated to improve themselves with the passing of time. Hence, the past becomes significant not as a tradition, a subject, or a value, but significant in terms of the contribution its traditions and subjects and values make to the solution of current problems and to charting the way for the future. A subject or a curriculum is important if it makes life better "in the midst of the living of it".

In schools and among teachers that you and I now know, you will find a basic separation in educational viewpoints. On the one hand there is the insistence that it is the sole obligation of the schools to transmit knowledge, that certain subjects have special merit in connection with mental development, that the institution or the teacher should decide what is best for learners to learn, that failure must be awarded if through indisposition or inability the student does not learn what has been judged to be good for him, and that education ought to be based on the requirements of adult living. On the other hand there is the insistence that people and their living are to be valued more than subjects, that what people are and do is even more important than what they know, that subjects are means to human ends (not ends in them-

selves), that the school must be concerned about learning that is carried over into conduct and action beyond mere remembering, and that pupil purposes and motivation are more important in pupil learning than teacher control and drive. The two viewpoints are not completely and mutually exclusive. Of the two, however, the fundamental goal and spirit of the latter gains the ground in this country. Basically, people are more important than subjects. What they are and what they do with what they know is more important than what they know. The practice of democracy, for example, is more important than a knowledge of history. A knowledge of history is important, but it is a means to a more important end. Doing, experiencing, sharing, cooperating, and managing are necessary in addition to knowledge if life is to be effective and satisfying. Knowledge, then, must improve the quality of present living. Without this, it is a tower without a light, and contributes little to man's control of his own destiny. A. N. Whitehead has put it this way:

"The solution which I am urging, is to eradicate the fatal disconnection of subjects that kills the vitality of our modern curriculum. There is only one subject-matter for education, and that is Life in all its manifestations. Instead of this single unity, we offer children – Algebra, from which nothing follows. Geometry, from which nothing follows; science, from which nothing follows; History, from which nothing follows; a couple of Languages, never mastered; and lastly, most dreary of all, Literature, represented by plays of Shakespeare, with philological notes and short analyses of plot and character to be in substance committed to memory. Can such a list be said to represent Life, as it is known in the midst of the living of it? The best that can be said of it is, that it is a rapid table of contents which a deity might run over in his mind while he was thinking of creating a world, and had not yet determined how to put it together." (A. N. Whitehead, *The Aims of Education and Other Essays*. The Macmillan Company, 1929. Page 10.)
It should be noted that Whitehead is not objecting to subjects, but to the "fatal disconnection of subjects" from "Life in all its manifestations". He wants something to follow on the heels of knowing that will make a difference in life as we live it. The attitude of mere acceptance, of supposing that a subject or a technique are forever good, is not enough. All that we do must ever go into the crucible of appraisal. The primary requirement, then, with reference to educational objectives, is that they always be subject to our best intelligence and be concerned with "Life in all its manifestations". This will not lead to uniformity in objectives, but it will keep our objectives from enslaving us and will make them adaptable to new conditions, new evidence, and new experience.

How does intelligence apply itself to educational objectives in our time? Let us mention two things briefly.

Certainly in our country one of the controlling elements, or new conditions that has had to be considered in determining our educational goals is our commitment to the concept of democracy. Democracy means many things – freedom, reverence for personality, the central position of the individual, self-thinking, individual judgment and inquiry, analysis, discrimination, attitudes towards others, working with others, personal responsibility for decision making, action based on intelligence, and the steady improvement of society through the thought and action of the individual acting singly or in concert with others. Schools in a democracy must operate with these things in mind—and must further them. The school cannot be, in policy, authoritarian, it cannot prescribe a single curriculum for all, nor can it bury the development of individual responsibility for self-thinking and self-direction under the smothering cloak of teacher domination. Wise self-direction is permitted; skill in working cooperatively with others is promoted; and the school, as a matter of policy, keeps its program flexible, so that it can meet the diversity found among its pupils.

Again, our educational goals are greatly influenced, or should be, by what we know about human learning. This is one of the primary themes of this conference. A lot has been discovered in this connection during the last half century. Time was when the mind was described as a wax tablet or a sheet of white paper on which the teacher wrote with some kind of magic stylus. Or the mind was a kind of post office with its pigeon holes or "faculties" with which one could deal separately and into which one could chuck prescribed facts and experiences. Better yet, the mind was a kind of sponge that could soak up the "drippings" from the mouth of the teacher and, at regular intervals the teacher could squeeze the sponge and get it all back again. At any rate, learning used to be looked upon as passive, receptive, submissive, doing someones else's chores, being a kind of cistern, sitting and taking it. Things are different now. We now know that learning is behavior. It is action. It its the organism reacting to its environment, meeting and solving its problems. These problems must be understood and accepted by the organism as its own problems; and, if learning is to be most effective, the urge to solve them must come from within. When teachers demand passivity, sitting and taking it, and mere acceptance by the student of their ideas, the motivation for learning is deflated, and the purpose and drive which ought to be in the student stand in danger of suffocation. Apparently, then, the idea of the dominant teacher with a demand for acceptance and conformity is out of line with what we know about the nature and conditions of learning.

Our educational objective then, must be flexible enough to adapt to new knowledge and new conditions when intelligent inquiry so indicates. They mirror the basic thinking of our people as they reflect on themselves and on their primary values.

Specifically, our people, thinking about their schools, have pretty well accepted the following objectives as being appropriate for our time:

Common to all Levels

1. Physical and mental health.
2. Effective social understanding and participation.
3. Instruction and practice in self-thinking and group thinking.
4. Creative expression.
5. Fundamental processes (in the more traditional sense).
6. Self and the physical world.

JUNIOR HIGH SCHOOL

7. Vocational exploration.
8. Self and society, including worthy home membership.

SENIOR HIGH SCHOOL

9. Elementary vocational specialization (including college prep).
10. Establishment of worthy leisure time activities.
11. Understanding of civic responsibilities.
12. Understanding and use of the scientific approach to problem solving.
13. Techniques of effective personal action and cooperation action.
14. Ethical character.

JUNIOR COLLEGE

15. Vocational specialization (Semi-professional).
16. General education (intelligent survey of areas of human knowledge: the common ground of thought and appreciation basic to mutual understanding, unity, and progress).
17. Philosophy of life.

HIGHER INSTITUTIONS, INCLUDING GRADUATE EDUCATION

18. Vocational specialization (professional).
19. Contribution to knowledge.
20. Assumption of leadership responsibility for the implementation in society commitments understood and adhered to.

In 1938, the Educational Policies Commission of the National Education Association grouped the objectives into four main categories:

(a) The objectives of self-realization
(b) The objectives of human relationship
(c) The objectives of economic efficiency
(d) The objectives of civic responsibility

One notes at once that all these objectives are stated in terms of people. Schools will organize themselves, administer themselves, adjust their curricula, adapt their methods, and build their buildings to achieve these ends for *people*.

Now let us as college people not feel too relieved with a classification of objectives according to grade levels. Educational objectives are cumulative; that is, as one is added, all the others are retained. College teachers and college students, therefore, must continue to be concerned about health, ethical character, and the three R's as well as to promote the objective of contribution to knowledge. One does not teach for a single objective, but for many.

It is useful, no doubt, to talk about educational objectives – their nature, how they should evolve, and what they may be at a certain time and place, but it is more important and more useful that objectives pay off, do some work, make a difference. Objectives ought to direct practice. They ought to be the drives that give meaning to practice. They ought to be the criteria against which practice is evaluated. They should be evolved both by groups and by individuals. It is important to me, for example, that my staff members consider and record their collective agreements as to what the general objectives of education in a democracy are and what the specific objectives of the School of Education in the University of Connecticut are. Each staff member should do this also, clarifying his objectives in his special work, and relating them to institutional and general goals. Until this is done, how can we expect improvement in some of our practices? Changes in practice will be invited only if they promote objectives we believe in. Changes, let us admit, are not always invited. Perhaps part of the reason is that we have not established our objectives, and the need for change is not apparent. Let us not contend that changes are not necessary, or that problems do not exist where they do – problems of teaching methods, of the selection and organization of content for teaching, of evaluative procedures, of administrative procedures, of teacher-student rapport, of kindling motivation for learning. These problems are dealt with in this conference. Let us only be sure that underlying our changes in these matters is the solid foundation of basic objectives that are clear and strong. Thus do our objectives go to work. They function when they stand as guides for the scrutiny and improvement of our practices. This, may I suggest, is lighting the light in the tower of learning.

SELECTED READINGS

1. Educational Policies Commission, *Policies for Education in the American Democracy*. N.E.A., 1201 Sixteenth Street N.W., Washington 6, D.C. 1946
2. *The Unique Function of Education in the American Democracy*. (1937)
3. *The Education of Free Men in American Democracy* (1941)
4. *The Purposes of Education in American Democracy* (1938)

NATURE OF LEARNING

MILTON O. PELLA
Assistant Professor of Education
University of Wisconsin

Teaching and Learning

If we are truly teachers, we have a fundamental or at any rate a characteristic similarity. We are interested in stimulating and guiding learning. Learning has been considered by many as synonymous with memorizing, or the acquisition of knowledge or skill. These are forms of learning, but are not the whole of it.

Learning may more properly be considered as a process of adaptation. Through the process of learning, individuals acquire new ways of behaving or performing or thinking so that they may more effectively meet life's demands.

Learning has been defined as the modification of behavior of an individual through experience and training. An individual learns when he needs to learn. He learns when his change in behavior satisfies his goals or motives. These goals or motives may be immediate or somewhat remote. His change in behavior may or may not be overt. His change in behavior may help him overcome physical or mental obstacles.

What kinds of learning do we desire? These learnings have been classified as understanding of certain facts, concepts, principles and generalizations; skills, attitudes; appreciations; and interests. Our attempts to stimulate and guide learning include the use of oral illustrations, reading assignments, pictures of many forms, demonstrations, a variety of types of models, field trips, laboratory exercises and written assignments.

These learning aids may or may not function depending upon the nature of the desired learning, the characteristics of the persons doing the learning, or the method of employing the aid.

Basic to the judicious selection and use of any learning aid is a functional knowledge of some general principles of learning. These principles of learning, like principles in pure science, describe rather than prescribe the way in which learning generally occurs. They are not statements of absolute fact; however, they are statements of relatively high probability.

A good source of information to be used in any study of learning is the individual learning without benefit of guidance or tuition. An individual, if properly motivated so that he experiences a sustained period of activity, may learn many very difficult things without the benefit of a teacher. This is evident from the fact that research is being carried on and new knowledge is being revealed. All knowledge originally came as a result of groups or individuals working without the benefit of anyone who knew *the* answer.

What makes this research possible? 1. A real interest in a problem. 2. A background of knowledge. The interest comes from the individual's keen sense of evaluating the worthwhileness of a possible solution to the problem. A solution to the problem is important to the individual. In his technique of attempting to solve the problem, he uses his background of knowledge. This saves him numerous hours of trial-and-error learning. Through the use of his background of knowledge, he formulates many plans and hypotheses. These he tries or tests; they may be successful or unsuccessful. He learns that one technique may give an answer and another may not. He is, at any rate, learning.

From these cursory observations we may glean some important knowledge of learning. 1-. The learner must see some need for learning. 2. This need must be a personal thing. The learner must associate the possible result with his own life and goals.

In schools we have teachers who assume as their most important task that of reducing the time required in achieving this learning. It is probably trite to state that time and good sense does not allow students to go through all the laborious tasks of discovering everything. In schools we have as a part of our responsibility that of passing on to the students at least a part of our cultural heritages in an efficient manner.

This kind of learning in schools is, therefore, somewhat artificial and externally imposed. As teachers, we must either remove or in some way reduce the barriers which are inherent as a result of the artificiality of the situation.

Motivation

The problem of how to help students see the worthwhileness of the learning, or of how to develop this conscious need for learning, is paramount in teaching. Some educational psychologists call this motivation. To motivate means to help students associate what is to be learned with meeting their own needs.

How is this done? A common procedure is to give assignments to be learned, and later, examinations to see if they have been learned. The motivating force here is the examination and resultant passing of the course. Let us be very liberal and attempt to justify this procedure. Some of the justifications given are: 1. The student doesn't know what is good for him. 2. This knowledge is prerequisiste to further knowledge.

No. 1 leaves much to be desired. If the student doesn't know what is good for him, he does not have a well-defined goal and is therefore not aware of the purposes of the courses. No. 2 may be justified in a sense. If the student sees the final goal but does not at the moment see the value of this learning, he may even be told, "This probably doesn't make much sense to you at the moment, but it must be learned before you will be able to learn this next thing in which you

see some real value." A student may not see the sense in learning how to make an emulsion if he is not aware of the use of emulsions in the practice of pharmacy.

We may therefore say that at times this kind of motivation can be justified. You will note, however, that even in this justification an attempt should be made to help the student see the learning in a larger context.

Motivation must not be considered as something added to an apathetic attempt to speed up or perpetuate the process of learning. It is an intrinsic part of learning.

Motives are conditions within the organism that dispose it to act in a given way. The fact that these are present in a great variety and are subtle in expression makes the teacher's task a difficult one. If any one conclusion from research relative to motives can be drawn, it is that students do have motives and there is no infallible set of procedures that serves to motivate all pupils at all times.

These motivating forces that have been found are classified as physiological needs and drives, goals, interests, rewards, punishments, and fears. The positive aspect of each of these produces the best results. To have definite needs and drives motivates the individual to satisfy them. Goals which the student has selected by himself or as a result of influence give direction to his activity and effort. Goals may be so remote that students lose sight of them. This requires progressive goal-setting. Students must often be helped to formulate sub-goals along the way. Teachers may be very helpful in assisting students in formulating these goals. Students with desirable interests will put forth more effort than those without them. Man is not born with interests. He develops them as a result of his experience. Too much confidence must not be placed on immediate interests, since they are more a reflection of the past than a prediction of the future.

Rewards may be artificial or real. A job well done should be an adequate reward. Artificial rewards are grades, membership in fraternities or sororities, honor rolls, etc. Punishments are generally considered detrimental to learning. That is, a reward is more effective than a punishment. Also involved here is the consideration of success and failure. Students will not put forth effort if they are constantly confronted with failure. Emphasis should be placed upon success rather than the fear of failure. This does not mean that every college student entering must graduate; however, it does mean that every effort must be made to help the student succeed. One of the most difficult adjustment problems of youth is that required by failure, if he does not see it as the result of his own doing.

Probably the best general statement concerning motivation is this: As a teacher, you must try to help each student associate himself with that which is to be learned. To do this demands more than sitting and listening to lectures. He must become an active participating part of the total learning situation.

A summary statement of these observations is that "Learning is Purposeful." The problem of motivation is that of helping students to fit the learning objectives into their specific or individual purposes. This gains support through recognition of the observable principle that learning is selective. It is a selective process, and selection is based upon individual purposes. The fact that individuals do make selections in terms of purpose indicates the will or desire to fulfill this purpose. This *will to learn* is a necessary factor if learning is to result. Students do have a will to learn if they have well-defined personal goals. The establishment of valid goals in the professional world comes to a great extent as a result of the development of proper attitudes. The best results come when students are helped to associate themselves as future professional workers.

Learning and Experience

From the foregoing statements, it becomes apparent that learning is an active process and is experienced only by the learner. The activity may involve physical participation or mental participation, or both. The learner must be an active participant if he is to feel a part of the total situation and learn. Learning is an individual process. Learning results from experience. Experience is an interaction of an individual with his environment. The reaction of the individual comes as a result of this experience. He has experience with phenomena, objects, and ideas. He learns from these experiences. What he learns depends upon the kind of experience he has. If his experience is with words, the result will of necessity be verbalism or a type of memorization. The quality of the learning depends upon the quality of experience. If new learning of a high order is to develop, it must have its basis in the past learning or experience of the student. A good teacher begins with the present abilities of the student to help him gain new or different abilities.

Generally, in an effective teaching-learning situation, some appropriate real or concrete experience is to precede or accompany a verbal experience. If verbal or vicarious experiences are to be used, they must be based upon the past real experience. Sometimes a teacher may make use of experiences students have had before entering the school. Nearly every human being has had experience with injections, serums, tablets, etc. These experiences are incomplete from a pharmaceutical standpoint, but may serve as a beginning point for discussion. "Here is a product that is not understood," and the problem at hand is to add to the present knowledge so that students may gain the necessary understanding.

Learning is developmental. A student rarely learns or thoroughly understands something the first time it is presented. He must mull it over. He must use it. Learning is a function of practice. Practice does not mean exact repetition of a response; rather it must involve variations. A student may be successful in compounding a prescription. This success may involve the employment of many wasted or unnecessary motions or activities. Through practice he should eliminate more and more of these wasted movements and achieve a smoother, more efficient performance. Principles in science must be considered from several aspects before understanding is achieved. Filtration, in chemistry, may be a mechanical process, or it may be understood, depending upon its repeated use and consideration in terms of its relationship with other facts. All this means time. Time is one of the dimensions of true learning.

Learning May be Reorganization

At times a student may learn new facts. At no time in a college course will he learn everything new. Frequently his learning will merely be the way in which his present knowledge is reorganized. The only new knowledge gained will be the method of organization of his present knowledge. Teachers must use the past experience of the student at every opportunity.

It may be said that learning is the progressive organization or reorganization of experience. Organization of any type depends upon relationships. A student experiences a succession of events or phenomena. It is when he discovers the relationship or interrelationship between the parts of a total situation that he has learned. This leads one to classify learning as a unitary phenomenon. That is, the reaction of the student is to the whole learning situation, and he makes selections of established purposes or goals. The student has the experiences with the whole, and from this whole he selects or differentiates the desirable from the undesirable and integrates the selected part into his past experience. When this has occurred, he has learned. Learning involves both differentiation and integration. Since this appears true, it also demands recognition of the time element. Learning is a gradual development process, and new learnings grow out of past or passing experiences.

Learning and Practice

To encounter a problem and overcome it once does not make for permanence in learning. Learning is a function of practice. We learn better those things that we use. Practice does not mean the exact repetition of a response. Practice must involve repetition of learning in many situations. Repetition with variation is more effective than repetition alone. All people enjoy making use of their abilities.

Transfer of Learning

Probably the one hope or assumption of all teachers is that learnings acquired in school in one context or situation will be applied to or affect behavior in another context or situation. This is one legitimate basis for schools. We do know that learning does transfer, but that the amount of the transfer varies. It may be generally stated that the education that has the maximum transfer value is the education that is best.

What brings about this transfer in one case and not in another is a question still without a definite answer. Arguments continue as to whether transfer occurs because of identical elements or components in the learning situation and the new situations or because the learner can and does generalize his behavior. Basic to these two general ideas is that of cognition by the learner. Cognition implies knowledge that extends beyond mere awareness. It involves the gaining of knowledge through personal experience.

The maximum transfer probably occurs when old learnings and new problems are interrelated because of similar or common elements, factors, or relations, or when they involve similar response patterns, skills, attitudes, appreciations, or knowledges. The transfer may occur as a result of the similarity between new situations and situations in which the knowledge was acquired. The recognition of the process or procedure of the original learning may cause transfer to occur.

It is apparent that the individual must recognize these elements or components. The element or component may be present, but unless it is recognized it will be of no value in supporting transfer. One important task of the teacher is to bring about awareness or insight into the interrelationships of old and new learning tasks.

Significance for Teaching

These learning principles are of little value unless they have applications in the solution of some teaching problems. A look at some may prove helpful.

1. *Learning is the modification of behavior.* The implication here is that individuals do have methods of behaving, but that these may not be adequate. In our teaching, consideration must be given to the behavior level of the students. Begin with the level of the student as he is found, and not as we would like to find him.

2. *Learning is purposeful.* Purpose in learning is personal and is therefore individual. Each student possesses or is helped to formulate valid goals. The teacher's job here is motivation. He must, if possible, help the student to see himself as a successful pharmacist and to see these learnings as important parts contributing to his success. It would seem that many references should be made to the successful pharmacist and to the use of incidents from the profession in introducing new topics. The study of ethics is replete with good incidents that will cause students to think about the problem. When they think about it, they are seeing this problem as theirs. "What would I do in this case?"

Trips to hospitals to see the use of drugs that have been compounded would do much to help students develop valid purposes.

3. *Learning is an active process and is experienced only by the learner.* Learning has not been known as a passive process. This does not mean that the learner must talk all the time or even be displaying overt physical activity. The activity may involve physical activity, but generally involves mental activity. Activity is a part of learning. As teachers, you are unable to provide experiences for students. You can and must provide experience opportunities that stimulate activity on the part of the learner. Lecturing may stimulate a kind of activity if it is well prepared, delivered by an animated speaker interested in students, and if the material to be learned is suited to lecturing.

The experience opportunity must be appropriate to the learning outcome. I doubt that any student ever learned how to fill capsules as a result of listening to a lecture. Further doubts may be registered with reference to skill in weighing and measuring, preparing waters, etc.

Since learning is purposeful and active it must be selective. In teaching, opportunities for learning must be selected in terms of purpose.

4. *Learning occurs when the learner discovers the interrelationships of the parts or facts of a total situation.* The *whole* situation involves both theory and practice. A chemical or physical change takes place. The knowledge of the change should precede an ex-

planation of what caused the change to occur. This means that demonstrations and laboratory work should precede or accompany the hearing about or reading about the changes. The changes give the student something to understand. The reading, explanation or discussion help him to understand it.

The experience with the concrete should precede or accompany experience with the abstract. During the concrete experience, the student should come to know changes or parts or equipment or material by names, as you will use them in the discussion or explanation. The laboratory and demonstration cannot function best unless it is used at the appropriate time. The learner learns when he discovers the relationship between the change and the explanation for the change. A learning situation is a package of parts that all fit together in a neat manner.

5. *Learning is the function of practice.* Use strengthens and disuse weakens. Practice means use in a variety of situations. The removal of colors from medicinals by mixing has many applications. These cause the student to use the principle and ultimately to learn or understand this technique.

When one practices or uses a learning product, he is organizing or reorganizing his experience. He sees the use of the learning product in a number of situations. As a result of this organization or reorganization of experience, he is able to generalize and to increase his experience with a multitude of elements. The generalization may help him to transfer this knowledge in a different situation. By increasing his experience with elements, he increases the probability of finding common elements in his experience and new situations. This increases the probability of transfer of learning. This is the final desire of the teacher.

MEMORIZING AND RATIONAL LEARNING

MILTON O. PELLA
Assistant Professor of Education
University of Wisconsin

In motor learning, responses to stimuli are overt activities observed in terms of muscular movements. Mental learning responses, however, are largely evidenced through language. Thoughts and ideas are represented by symbols. Since a major part of the work of the school at all levels involves the use of symbols, mental learning is extremely important. Mental learning advances the student beyond the habit and skill level in his behavior.

An exact definition of memory learning is difficult, since such a definition must include many types of memory learning. Probably the most definite definition is to the effect that "memory is an image of a past experience with an awareness on the part of the individual that it is a past experience." The image recalled may be a judgment, concept, percept, fact, etc.

Memorization is an important type of learning, especially when it is combined with other types of learning. This is especially true in the early years of professional training. The pharmacist must learn a vast number of facts, principles, and generalizations in science which he later recalls and applies to the practice of pharmacy. Memory-type learning enables the student to recall and retain these useful materials.

Memory-type learning involves approximately five phases or steps. These five steps are important, since they give some hints concerning the more effective direction of learning. The five steps have been given several different names. Here we will use the five given as reception, registration, retention, recall, and recognition.

Reception

Basic to all learning is the demand on the part of the learner to receive stimuli and on the part of the teacher to make the stimuli forceful enough so that the student will receive. This demands good attention-getting stimuli. This demands stimuli which will excite the proper receptors. Motion gets attention. Relating something to an existing past experience gets attention. Objects get attention. Change gets attention. Auditory stimuli coupled with visual stimuli are more effective in many cases than either alone. Tactile stimuli coupled with visual and auditory stimuli are generally more effective than either alone. It may be generally stated that the greater the number of sensory receptors stimulated, the greater the possibility that the stimuli will be received.

Registration

The next facet of memory is registration of the stimuli on the nervous system. Stimuli may be received and not be of sufficient intensity or of the proper type to be registered by the nervous system. People listen but don't hear; they look but don't see. For stimuli to register, the organism must discriminate. The teacher must assist the student in his discrimination of stimuli so that he sees what he looks at or hears what he listens to. Discrimination and ultimate registration of stimuli demands that the student be willing to receive stimuli and allow them to register. He must see some value in the reception of that to be received and recorded.

This further demands a reduction in the number of competing stimuli to which the learner is subjected. The number of distractions from the desired stimuli are to be reduced to a minimum. With many different stimuli, the learner may record those not desired rather than those desired.

Retention

This brings us to the next facet, which is retention. It is more than mere record-making by the nervous system. Once a record of an experience has been made, it must be retained, or in some way the impression must be made adequate so that it does not become lost. The retention of learning has some relationship to interest. A learner has some subjective preferences which regulate his activities to a degree. These preferences are called "interests". With interests come desires. The conclusion generally formulated is that the desire or will to remember is an essential determining factor in memory.

In addition to interest, other factors have been found helpful to the retention of learnings. Remember that interest is a basic factor in learning, since it is through interest that the energy is released by the learner. Repetitions are said to improve impressions, but mere repetition alone actually does little or nothing. Repetition with an intent to learn or improve is effective. Concentration of attention improves impressions. Establishment of the proper emotional state on the part of the learner improves impressions. Reference has been made repeatedly by psychologists to the whole or part method of learning. Statements have been made that in learning large masses of material, the whole method is superior to the part method. This is true if the whole is not too overwhelming. If there is a great deal to be learned, break the whole down into parts and learn the parts as wholes. In pharmacy, the student is required to learn the source, common name, dose, technical name, etc., of the drugs. He should probably first learn them one at a time as units. That is, quinine, cinchona bark, etc. He would then move to the next drug. This method is further supported by the fact that organized materials are more easily learned than those that are disorganized.

Recall

The above statement is important to the next facet, recall. To recall means to recollect. To be able to re-

collect demands more than repetition. To be remembered, an idea must be attached to others by definite associations. The concept of associations has been given many descriptions, and no attempt will be made here to justify or deny any of these descriptions or ideas. The word association is here used to denote connections or a myriad of interconnections formed between facts, ideas, events, etc., by individuals. To be remembered, learnings must be associated with cues or a system of cues. That which is to be remembered is to be associated with experienced facts, so that they come to mind in connection with a stimulus. A mass of unrelated, isolated facts, dates, formulas, etc., is entirely useless. When they become organized or related to already acquired knowledge, they are useful. This organization or relationship is the formation of the needed associations. Another look at the previously noted branch of pharmacy may be important here; after the student has his first plant, its drugs, the mode of extraction, dose, etc., he has a kind of organization established. In the future learning of other drugs, their sources, etc., he will modify this organization through building new associations. Another drug that is prepared in the same way from the same part of another plant has a dose three times as large as the first, and is a nerve stimulant rather than a depressant, etc. Or he may classify the drugs as stimulants, depressants, cathartics, etc., as he goes along. He may classify or organize his knowledge according to the ways in which the drugs are extracted. In each case, he is expanding his associations and increasing the probability of recall.

Often the classification of associations or memory is made into three divisions:

1. Mechanical memory. In this type, the associations are artificial and mechanical. This occurs when a mass of material that is not understood is memorized: The formula for the area of a sphere, a list of names of plants or plant products without having seen either or without knowing their uses or modes of extraction. Learning how to spell words. This is generally referred to as rote memory. It involves the exact memorization of material. It is mechanical. Rote memory does not involve a great deal of meaning.

2. The second form of association used in recall depends upon some ingenious connection between a cue and that product to be recalled. These may be artificial cues as those developed to remember the names of the colors of the solar spectrum: Roy G. Biv. This may be a way to remember meaningless facts, but should not be used in remembering facts that are of value because of their meaning.

There are many situations which demand a high degree of accuracy in reproduction. The multiplication tables, mathematical constants, formulas, certain laws, etc., require accuracy and precision of reproduction. However, before rote memorization is employed, the teacher should, wherever possible, endeavor to develop, as thoroughly as possible, an understanding or comprehension of this meaning, application, or interpretation of that to be retained.

3. The third form is that referred to as logical recall, or recall through logical memory. This comes about as a result of understanding the significance of each topic in a system of thought. Logical learning involves comprehension of a whole without memorization. There is no need for verbatim reproduction if the student understands the principles or relationships of a total situation. Logical memorization comes about as a result of rational learning.

All recall is through association, and association is the relation that exists between experiences. These experiences must have, wherever possible, a mental and physical basis. The richer, more organized, and more immediate the association, the richer and more lucid the recall.

Recognition

The fifth facet has to do with the recognition of that recalled image as a past experience. Recognition requires a rich background of meaning, so that the image is familiar in many settings or situations.

Improvement in forming associations is accomplished by repeating the association until it is firmly fixed, by substituting logical for ingenious or mechanical associations, and by organizing isolated types of associations into logical systems. With this improvement of associations comes increased recognition, since recognition requires a rich background of meaning and familiarity.

Economy in memorizing

Since memorization is so important, how can we memorize most economically? It is valuable and important to efficient learning of a higher order.

Mechanical memory is invaluable during early stages, but becomes undesirable in subjects where reasoning, judgment, and logical memory are required. To make for relative permanence of learning, overlearn.

Students often think they learn when they cram for an examination. By cramming is meant the postponement of any logical, systematic study until shortly before the examination, and then relying upon intensive mechanical memorizing to carry one through the test. Often the result is distressing on the immediate examination, and is usually distressing when considered over a long period of time. Intensive review is beneficial, but only after the course has been mastered. The review helps the student to organize, reorganize, develop further associations, and to overlearn.

To memorize effectively, perform the act, exercise it under many circumstances, and have a feeling of joy or satisfaction accompany every exercise.

Memory is necessary for all learning. It is a prerequisite to constructive imagination, thinking, and the resultant problem solving or rational learning.

Logical Learning

Logical learning should, wherever possible, take precedence over any attempt at rote memory. The main purpose of rote learning is to place a reaction on an automatic level after it has been comprehended as a result of logical learning. Only after a student has developed meanings and some comprehension of the material learned can this become a part of his equipment for thinking.

The "meaning of content" is the difference between rational and rote learning. In rote learning, meaning is absent. In material that has been learned

logically, the learner sees and understands its origin, development, and the relationship of each part to every other part and to the whole. In the case of coherent and meaningful materials, the chief memorial support consists in the apprehension of the meaning and the logical context. The pedagogical meaning of this is important. The memorial acquisition of meaningful material can be facilitated by clearly explaining to the pupil the context and the coherence of the parts of the whole idea, principle, phenomenon, or event.

This requires the learner to first get the general picture or idea of the whole, and later to pay particular attention to the more essential details and the interrelationship of the details. At times the interrelationship of the details can be discovered by the learner, and at times it must be pointed out by the teacher. The discovery by the learner is more satisfying and therefore makes for better retention.

To assure the development of maximum rational or logical meaning of any context, a teacher should begin with those parts most readily understood by the learner. He should help the student progress from the simple to the complex; from the meanings now possessed by the student to new and broader meanings of content.

It has been found that the solution of problems promotes the development of meaningful learnings. The steps in problem solving are given as (1) the recognition of a problem, (2) collecting information about the problem, (3) formulating hypotheses with reference to the method of solving the problem, (4) testing the hypotheses, (5) formulating conclusions.

How does this help in teaching? Recognition of the problem implies the acceptance by the individual of a deficiency in his ability to react to his satisfaction to a given situation. It further implies that the problem is in some way connected with his past experience.

In collecting information about the problem, he draws on his possessed knowledge. He has the opportunity to begin with the simple and advance to the complex.

The formulation of a valid hypothesis calls for reflective thinking. What are the important parts of the problem? What relationships exist among these important parts? What relationship might exist if one were changed? This helps the student analyze and discover the details after he has studied the total.

To test a hypothesis calls for constant and careful scrutiny to determine cause and effect relationships. This contributes by adding meaning to the content.

A conclusion is a statement of the results of repeated observations of relationships of cause and effect or the sequence of events. This means more associations are formed.

Implied here is the necessity for some use of inductive rather than the exclusive use of the deductive method of teaching. In some cases, the student should be given the privilege of going through the development of a generalization as a method of rational learning. This is by no means the only method of helping students to learn by developing rational or logical meanings for words or phrases. This may also be done by employing the deductive method. The statement of the generalization is given and then the reasons or supporting facts are given as the means of developing meaning for the content.

No hard and fast line can be drawn between rote memory and logical memory. Many degrees of logical meaning are to be found among the possessors of knowledge. In no one case will a 100 per cent meaning be found by any possessor of knowledge. Needless to say, the degree of meaning determines the degree of usefulness of the knowledge.

Material learned to the level of rote memory is applied by its possessor by rule, not by reason. In beginning chemistry, physics, and biology, the student is compelled to learn many facts by rote memory. These are generally not retained for very long. When the student is found in a more advanced class, the teacher may demand that he use these facts. When he is unable to do so, the teacher informs him that he doesn't know the prerequisite material. After the teacher, who knows the relationship of the old and the new, points out the principle involved, the student better understands, and may even remark, "How could I be so dumb?" If you were called upon to interpret a strange situation or a new problem, you would use the knowledge that has some meaning and rarely if ever the knowledge that exists as a rote memory passage. It seems wise at this time to plead for more thorough learning of a few things at the elementary level rather than rote learning of many things.

Learning products and processes are important only as they help us to do what is commonly called thinking or reasoning.

If our thinking is to be sound, it is important that we have a correct and complete concept of the object, phenomenon, or event with which our thinking is concerned. We must know the definitions of terms as the terms are to be used. We must know the existing relationships between the things or concepts we are dealing with. We must know about similar objects or phenomena. To do original thinking, we draw on our background of logical understandings and reassemble these in a seemingly rational or logical manner. The rote learning plays little if any direct part in this highest of all mental functions called thinking.

PERCEPTUAL AND MOTOR LEARNING

MILTON O. PELLA
Assistant Professor of Education
University of Wisconsin

Probably the most fundamental of all learning is that called perceptual learning. In fact, there could be little or no learning without perception. It is essential to understanding, imitation, imagination, and reflective thinking. This means that the outcomes of perception are knowledges, skills, and problem-solving abilities.

All teachers, to greater or lesser degrees, make use of some knowledge of perceptual learning. They may not be able to state the employed principles, but these nevertheless are used. This is true in nearly every phase of life. We do not think of Boyle's law every time we breathe. We do not always think of formula for kinetic energy when driving an automobile. All learning, however, serves to modify our behavior after we possess it. This modification may only be the removal of some question in our minds, or it may cause us to react overtly in different ways.

Perception is the process through which people become aware of objects, transpiring events, or phenomena. Perception is the consciousness of particular objects, events, or phenomena present to the senses. It is obvious that perception involves the receipt of sensory stimuli and mental activity as well. Perception is an activity of the individual. It has its basis in self-experience. The experience is the result of stimuli received through the visual, auditory, taste, tactile, or olfactory sense organs. All perceptions are based upon the stimulation of some one or more sensory receptors. Perception is more than a mass of sensations. Experiences with colors, odors, tastes, etc., may occur without learning. The impressions made on the senses must be translated into awareness of the objects, events, or phenomena.

A person may see an object and not be consciously aware of it. Only when the object, phenomena, etc., becomes focused in consciousness is a percept formed. An individual may observe a color but not know what it is. After he knows the color to be red, he forms a percept. Our knowledge of the world of objects, events, and phenomena is the result of our perceptions.

The second component of perception is mental activity. This involves experience, since mental activity is possible only if a background of experience is a possession of the individual. An association must be established between the sensory experiences and the past experience of the individual.

The perception of events, phenomena, or objects is essentially a process of organizing and finding significance in the aroused sensory experiences. In reality, perception gives meaning to sensation. Through the combination of the elements of perception and sensation, the mind attains intellectual cognition.

Organization of Sensory Field

The sensory field of perception exists in different kinds of organization. The organization may involve the object, phenomena, or event, and the background or environment of the object, phenomena, or event. The thing to be perceived must stand out against the background as the sun stands out against the background of the sky. The background or environment may determine what is gained from observation. Some differentiation must be made between object and background.

The use of this principle is important in planning laboratory activities, demonstrations, other visual aids, and lectures. The important observations must not be masked by a myriad of detail. The important observations to be made in the laboratory should stand out against the background of detail. Demonstrations of principles or skills must begin with gross observations and gradually approach the details. In lectures, the background material presented must not hide from the student the important points or learnings.

Somehow the pattern of the stimulus affects the perceptual activity or organization. Stimuli which have a pattern of organization, the more obvious the better, aid the reception of the stimuli by the receptors. The arrangement may be spatial, temporal, or positional.

Any degree of understanding of this principle prohibits the employment of teaching without planning. The plan for teaching must include an organization of material to be learned. This does not mean placing all the demonstrations on one day or having laboratory activities divorced from the balance of the course. The observational opportunities must also be organized in terms of the outcomes desired. Rarely is there a single observation made from a laboratory activity. The sequence of observations may mean the difference between learning and not learning. A learning situation is to be organized so that each element stands out and still bears as obvious a relationship to other elements and the total as possible. Lectures, laboratory activities, demonstrations, films, pictures,models, etc., are to be utilized when each will make some element most vivid.

Too frequently there is no apparent arrangement to desired learnings, and learners are forced to group or arrange stimuli on their own. At times the result is not the correct perceptual understanding.

The organization of a new stimulus, to be most effective, should involve something familiar to the student. It has been found that being familiar with some object or part of an object enhances the formation of needed perceptions.

When this principle is considered, a teacher comes to but one reasonable conclusion. In the process of teaching a new understanding, include something familiar in the early stages. Begin with the perceptual

and experience level of the individual, and build from there. To understand a new theory, one uses his possessed knowledge of other theories. At times it has been found helpful to include analogies when describing something heretofore outside the experience of the student. Obviously, the analogue must be common to the student. Perception depends upon the past experiences of the individual.

Another factor in organizing the stimuli of a sensory field in perception is the expectation of what to see. This means that there will be a type of result. A student need not know the result to be observed, but should know the class of observation to be made, such as: color, state, size, etc.

A good arrangement or organization of learning materials in terms of background pattern, familiarity, and anticipation favors learning.

The importance of arrangement or organization of materials of learning is more fully realized when it is pointed out that perception involves discrimination. The learner must be able to discriminate between sensory elements. If discrimination of the elements of a total sensory experience is impossible as a result of there being too many similar elements or a defect of a sensory organ, learning will be impossible.

Objects and phenomena are not perceived for themselves alone. Objects and phenomena are more often perceived as representatives of a group or fact. Our perceptions are symbols of a fact. Oral and written words or numbers and signs are symbols, and bear meaning of a higher order than the sounds or symbols themselves.

Our perceptions are not an inherent quality of birth. They are not immutable. They grow and change as they grow. They broaden as they are enriched. They become more detailed and specific. As they grow, they tend toward greater economy. They become more efficient through the elimination of superfluities.

In addition to this, the reception of stimuli may be reduced to a cue. An entire group of meanings may be perceived from a single stimulus. In this process of cue reduction, a part stands for the whole.

We may well ask, "How are perceptual meanings enriched?" Perceptual meaning may be enriched through action. The fact that mercury is more dense than water has some meaning to an individual who has learned the meaning of the word "density". The perceptual meaning is much enriched when the individual has the opportunity to weigh equal volumes of water and mercury.

Perceptual meanings are enriched by careful inspection. A flower has a fuller meaning to an individual who has carefully examined one or several flowers piece by piece, and has dissected one or more in a systematic manner. The systematic search for similarities and differences alters the perceptual meaning. This study increases the comprehension of the object by the individual. This increased comprehension further increases one's perception. A student of pharmacy sees a container of compounded drugs. A student with no training may see the same container of compounded drugs. Upon examining the formula of the compound, these two individuals see different things. The trained pharmacist looks at the formula and sees that various elements are included and finds that one may be included to counteract the undesirable effect of another. The untrained individual may find the formula to be merely a collection of meaningless words.

It is apparent that the past experience of the individual is of extreme importance in all learning situations.

Words are hollow sounds or an aggregate of letters unless they have behind them a meaning derived from experience with objects, events, or phenomena. In teaching a process, it is advisable to first introduce the process. Analyze this into its various components through directed observation. When the student is well acquainted with the process as a sequence of changes, the time has come to explain the cause of the changes or the theory of the changes. As a result of this procedure, the student will be more likely to gain a perceptual understanding of the process. The words describing it may be the cues which cause him to recall the process. He will also be able to use this knowledge in further increasing his perceptual understanding.

In addition to these factors, one must realize that mental sets, prejudices, biases, and emotional states are important in perceptual as well as other types of learning.

Students often fail to learn well or thoroughly because they lack the needed perceptual experiences. If a teacher teaches above the student's level, he is not supplying the student with the needed perceptual experience. If the new subject matter is above the level of the student, little or no association occurs because of a lack of the needed experiential background. Only if the learner has the proper percepts will he comprehend the words.

Generally, there are two violations in teaching in this regard. (1) The prerequisite percepts have never been formed, or (2) the percepts already formed are not used in interpreting new situations. Without due cognizance of these two general violations, the learning will be of a low form — rote memorizing.

Motor Learning

Motor learning is the term used to describe the way in which a person learns to do something. The end products of motor learning are generally of two types: sensory motor skills and perceptual motor skills. Perception is involved in the acquisition of both types of skill. Every system of movement that is learned is associated by seeing, hearing, feeling, etc. Once a sensory motor skill is acquired, thought is no longer required for its performance. It has become a habit. Thought is not required in walking, running, etc. A perceptual motor skill is in reality a refined pattern of movement based upon the perceived demands of the situation. The action is subject to modification based on the varying conditions of the situation. In mixing materials together, one may possess extreme skill in accurate measurements and not be particular concerning the sequence of measuring and mixing. When he is presented with the task of mixing water and a strong acid, one becomes particular to always add the acid to the water. This is a modification of behavior based upon the perceptual background of the performer.

In teaching, our greatest concern is with motor learning of the perceptual or cognitive type. Motor learning must not be considered as a simple mechani-

cal process. Kinesthetic perception is a fundamental, so the development of skills involves responses to objects and persons. To respond demands the reception of stimuli. Motor learning of the type most commonly dealt with in the sciences is directed primarily toward manipulating or acting in reference to an object, a situation involving many objects, a sequence of changes in an object or objects, or some situation of events or phenomena. Skill is the desired outcome. Skill is measured in terms of speed or degree of precision of obtained results.

Skills of all types involve qualities of style, form, and organization. These qualities are not capable of absolute definition in any performance. No two people possess the same kind of handwriting skills when these skills are evaluated in terms of quality. No two people use a mortar and pestle in exactly the same way. Each individual has his own peculiar way of carrying out any skilled action. It is impossible for one individual to exactly copy another. This does not mean that the development of skills is to be left to trial and error. Even though there is no *one* way to do something, there are good forms and bad forms. The job of the teacher is to help students develop good and efficient form, style, or organization, so that there is to be a minimum of time and effort utilized in the performance of necessary skills.

Motor learning, like any other form of learning, must have purpose known and considered valuable to the learner. Efficiency has meaning only when the requirement is related to the goal. Your students will develop new and more efficient methods of performance of tasks which now require a great deal of time and effort. The present status of many skills is probably the result of our willingness to stop improving when a practical rather than an expert level of achievement has been attained.

Motor learning also demands activity of overt and mental forms. A learner may observe a demonstration of an action. He thoughtfully observes each action and the results of each action. He tries to achieve his goal and makes mistakes. When he thoughtfully considers his acts and mistakes, he will show improvement. To get most rapid learning, the learner must possess insight into the actions and results. Teachers must aid the student in getting this understanding. There must be a reason for doing everything. The student finds much difficulty in achieving the level of efficient learning if he is merely following rules without reasons.

Understanding is also dependent upon the learner's intent to learn. If he has a desire to improve, he will improve until he reaches his limit. Students speak every day, but the practice alone does not bring improvement. To improve, they must be aware of ways to improve and have a desire to improve. The blind following of the rule "Practice Makes Perfect" will produce no desirable results. It may be that only a small amount of practice will bring better results if the student is helped to become aware of his difficulties, the way in which this skill contributes to his desired goal, and if he possesses a desire to improve.

Developing a Skill

The learner of a skill must always possess some concept of the desired results. This concept may be very crude or refined. This concept is gained through observation of the skill and reflection upon his observations. His initial observations are of the whole process, with little or no attention given to details. The teacher may be giving an explanation or he may be giving manual guidance. It is good practice to keep details to a minimum during early stages. Opportunities must be provided for the learner to get started on his first trial. If this is to be most effective, the student should enjoy some success. The successive trials must be guided by drawing attention to difficulties and by the learner reflecting upon his actions.

The early stages of direction may be verbal (either written or oral), demonstrations, or manual manipulation by the teacher. Each may be used alone or in combination with others.

Verbal instructions pose some real difficulties in comprehension. Verbal descriptions are difficult because of the variety of past experiences of the students. They are long and boring and usually involve a vocabulary not possessed by the students. Verbal descriptions alone are generally of very little value in the early stages. In more advanced stages, they may prove valuable.

Generally, some form of demonstration is the fundamental form of instruction in the early stages. This may be supplemented by oral or written instructions. Do not attempt to give a slow-motion demonstration. This causes the movement to lose its form and style. If slow motion is desired, a motion picture may be used.

It is well to bear in mind: 1. That meaningful skills will be retained well. 2. That retention is enhanced by overlearning. 3. Learning with the intent to retain is more permanent than learning for temporary use. 4. Distributed periods of practice are more effective than concentrated, prolonged periods for retention.

Further, you must remember that rarely, if ever, do you teach something completely new in a college class. If we are to be most effective, the "new" learning will begin with the old, and the attention of the students will be directed to the use of the old skills in the performing of the new.

READING REFERENCES

Skinner	Educational Psychology, Chapters III, V, VII, XII, XIII
Strong	Introductory Psychology for Teachers, Chapter 7
Thorndike	Human Learning, Chapter 8, 9, 10
National Society for the Study of Education	49th Yearbook, Part I, Learning and Instruction
Comments	Principles of Educational Psychology, Chapters 11, 12, 13, 14, 15, 16, 17
Davis	Psychology of Learning, Chapters 3, 6, 7, 8
Gates, et al.	Educational Psychology

THE LECTURE METHOD
DISCUSSION, QUIZ AND RECITATION METHODS

ROY O. BILLETT

Professor of Education
Boston University

On your program it appears that I am to talk for two different periods of time, first on the *lecture method*, then on *discussion, quiz and recitation methods.*

I think I should explain at the outset that I see these teaching-learning methods, and *other* teaching-learning methods, (several of which I will name in a moment) *not* as independent integers, but *as integral parts* of *one comprehensive, general method of teaching.*

Therefore I find it impossible to discuss the aforementioned, or any other specified methods of teaching seriatim, without reference to their interrelationships, and to the place of each in a valid general method of teaching.

I believe you would find an analogous difficulty if you were to try to discuss the atoms of a molecule, seriatim, without any reference to their interrelationships, or to their places in molecular structure.

However that may be, before I try to say anything much about any of these methods, I should define some of the terms I have just used.

By *method* I mean merely an orderly, systematic way of doing something.

By *teaching* I mean guidance and direction of the efforts of students in the hope that they may learn something. Both *hope* and the *subjunctive mood* are used advisedly. If they learn anything they will learn through their own efforts. And it will be partly accidental if they learn anything.

To continue with my definitions, I see *teaching method* as a continuum ranging from the most general at one extreme, to the most specific at the other extreme. In between are many methods which I call *intermediate* methods, and to which *lecturing, discussion,* and *questioning* belong.

A *general method of teaching* is not so-called because it is vague or indefinite. It is so-called because it is equally, hence generally, applicable to all teaching-learning situations regardless of the age level of the students or of the subject-matter primarily involved.

For example, all teaching should involve the establishment of teachers' objectives in terms of something to be learned by the students. All teaching should involve the suggestion and guidance of student activities likely to result in the development, to some extent at least, of the desired learning products. All teaching should involve the development and use of evaluative procedures intended to reveal student achievement and progress. And in courses of a vocational nature, a strict minimum standard of achievement should be enforced.

A good general method of teaching *always* involves all three of the elements just named.

Very specific methods are limited in their application. The additive method of teaching subtraction is limited to a specific area of mathematics.

Although intermediate methods are integral parts of general method, they too are applicable in any course regardless of the subject matter primarily involved.

In talking about teaching methods of any sort, we should never forget that they are *means* to *ends* not ends in themselves. In other words, teaching method has no significance except as it stimulates effective student activity. Translated into student activity, what do these intermediate teaching methods I am supposed to talk about involve?

They involve:

1. listening to lectures: which have many variants —which may be the instructor's own — or a visitor's — or a commercially or otherwise recorded lecture.

They involve:

2. participating in discussion: which has many variants — which may involve an entire class led by the teacher — or the entire class led by a panel — or the class divided into a number of small groups, dealing with the same or different problems, and directed or nondirected (I throw this last word in as a sop to any auditors who know what it means. I don't.)

They involve:

3. quiz and recitation: which have many variants— which may involve questions asked by the teacher — orally or via mimeographed study guides. Or questions asked by the author of a text or laboratory manual. Or questions asked by the students at the beginning of a lecture or discussion, or during a lecture or discussion, or at other various times and in other various ways. They also involve the answering of these questions.

But no good course is limited to the variants of these three teaching methods or to their corresponding learning activities.

In any good course students also learn

1. *Through reading.* Including the use of reference books, card catalogues, indexes and tables of contents.
2. *Through giving or watching demonstrations.*
3. *Through conducting individual or group experiments.*

4. *Through individual or group field trips.*
5. *Through making, using, or reacting to a great variety of audio-visual aids, including slides, maps, charts, graphs, and tables.*
6. *Through notetaking.*
7. *Through memorizing.*
8. *Through outlining, organizing, and summarizing.*
9. *Through engaging in practice of a primarily motor nature.*
10. *Through making oral reports.*
11. *Through making written reports.*
12. *Through applying and using what has been learned. (Review)*

The problem of the teacher who is concerned about his methods, is how to strike a happy balance and proper integration of the large variety of potential teaching-learning activities for each student. And he knows that a happy balance for one student is not necessarily a happy balance for any other student. The solution must provide for individual differences.

I find a comprehensive study guide indispensable in the solution of this problem in any course. Such a guide lists topics in sequence; suggests readings, suggests questions, problems and other activities, provides special study guides, and provides a matrix for the instructor's lectures, extemporaneous questioning, discussion, and other improvised methods as work with the class proceeds.

With the preceding facts in mind I suggest the following questions as a first step toward developing a rating scale for judging anyone's use of the lecture method:

1. Is it methodical, presenting major points in good sequence?
2. Does it show that the speaker not only knows what he is talking about, but also comprehends the implications, humorous and otherwise, of what he is saying?
3. Is it delivered with acceptable rhetoric, grammar and voice?
4. It is integrated with questions asked by the students at the beginning of the hour either orally or in writing?
5. Does it survive the shock of occasional questions asked by the students during the hour?
6. Is it well-integrated with the teaching-learning activities suggested in the study guide?
7. Does it supplement rather than duplicate what the students have learned in other ways?
8. Is it obvious, as it is delivered, that the lecturer expects something educative to take place between lectures?
9. Does it stop promptly when the allotted time is up?

The good lecture may serve in one or more of four ways:

1. It may *vitalize.* (Motivate; inspire)
2. It may *summarize.* (Principle of review)
3. It may *emphasize.* (Points particularly in need of stress)
4. It may *economize.* (Students' time and effort)

Lecturing has the greatest validity for students who are older and brighter. Hence it is justifiable in larger doses for college students than for junior-high-school students.

I am content to let you say in the discussion period which follows, anything further which you judge important about lecturing as a teaching-learning procedure.

Now what can I say about quiz, recitation, and discussion as intermediate teaching methods? For one thing we can say they are greatly overlapped aspects of one and the same procedure. However, there are some differentiae.

Quiz has two meanings which I am sure everyone here has seen well exemplified by one or another teacher.

Quiz may mean to ridicule, to banter, or to eye mockingly. As I say this, a certain college professor appears out of the past in my mind's eye, as real as life.

Quiz may also mean to examine, or to instruct, by close questioning. So interpreted, administered in small doses, and properly integrated with other teaching-learning activities, such oral questioning is a part of all good teaching. And as students we have all experienced this and profited from it.

But, administered in large doses, to the practical exclusion of all other teaching-learning activities, or at least reducing them to an irreducible minimum, quiz becomes congruent with the most unpsychological and most inefficient method of teaching ever to achieve wide-spread use. Of course, I refer to the method of the recitation, which has been authoritatively defined as "A class exercise in which students reply orally to questions for which previous preparation is assumed." The general invalidity of this assumption, as well as the general inefficiency of the method will be postulated here. Probably no one in this audience would seriously propose the recitation, so defined, as a desirable teaching-learning procedure. The instructor, with his class-book in hand, asking questions, hearing answers, and entering a mark every time any one "recites", so far as you are concerned belongs to the days of Charles Dickens or before. Do you remember how he wrote in *Hard Times*:

"Mr. Gradgrind's gaze swept over the class until it rested on the new girl. Immediately his questions began to search for facts, facts, and more facts. What was her name? Why did her father call her Sissy? He must stop doing that. What did her father do for a living? A horse rider? Certainly not — perhaps he might be described as a veterinarian, a farrier, or possibly even a horsebreaker.

'Very well then. Now give me a definition of a horse.

Sissy blushed, stammered, and remained silent. She had lived around horses all her life, but never before had anyone asked her to define the animal. Mr. Gradgrind was greatly irritated. Here was quite evidently a very stupid pupil with no facts in reference to the commonest of animals. He turned to a pale anemic boy.

"Bitzer, your definition of a horse".

"Quadruped. Gramnivorous. Forty teeth, namely, twenty-four grinders, four eye teeth, and twelve incisors. Sheds coat in spring. In marshy country sheds hoofs too. Hoofs hard, but requiring to be shod with iron. Age known by marks in mouth".

Thus, and much more, Bitzer.

"Now, girl number twenty," said Mr. Gradgrind,

"you know what a horse is."

Questioning will never cease to be an important teaching-learning technique. It will always be an indispensable technique. Teaching and learning will always begin and end with questions. But it will always make a lot of difference how these questions arise, and what is done about them by teacher and students after they arise.

I have already pointed out that a large proportion of a good study guide consists of questions. It is of course not assumed that all questions will be or can be presented via the study guide. Nevertheless, here are some obvious advantages of questions presented to the students in this way:

1. Such questions can be phrased in the best possible way. This is seldom true of extemporaneous, oral questions.
2. The questions of the study guide can cover the area of study far more comprehensively than oral questions.
3. The questions of the study guide can be referred to by the student wherever and whenever he wishes.
4. The questions of the study guide can provide much of the guidance needed by the students in the laboratory or workshop phases of the course.
5. The questions of the study guide provide a basis for impromptu, student-conducted discussions outside the class hour.

I have also pointed out how a good lecture may very well be interspersed with questions, mostly extemporaneous, but some with malice aforethought. Some of these questions will come from the instructor. He may want to

1. Discover whether he is getting his ideas across.
2. Rouse the somnolent.
3. Break the monotony with some discussion.

Some of these questions, we hope, will come from the students.

Any question raised by any student is a good question. At the very least it will reveal something about the student's attitude toward the course, and possibly something about his grasp, or lack of grasp, of the subject.

Furthermore, any question raised respectfully by any student merits respectful treatment by the instructor. I have found that dumb questions are sometimes only superficially so. And even if they are dumb they are important clues to needed instruction.

By the same token any respectful answer given by any student to a question raised by the instructor or another student, merits respectful treatment. Dumb answers are sometimes only superficially so. Something can and should be salvaged from every answer.

Some questions will always be better than others. This is true whether they come from the instructor or the student. It is true whether they come orally or in writing. The quality of questions will always be to some extent a function of the questioner's intelligence, what he already knows in the area of the question, and his desire to know more of truth.

So much for the motivation and guidance functions of questions. What about the use and relative value of oral and written questions for the purpose of evaluation — finding out what the students have learned up to a certain point? I would say it is possible to learn far more in ten minutes, about the preparation of a class, by means of a fifty-item objective test than could be learned in an entire hour by oral questioning. Such a series of mimeographed questions stimulates student self-evaluation. It provides the basis and leaves time for small-group discussion.

Now I would like to make certain observations about discussion as a teaching-learning procedure.

I. *Some common origins of discussion as a teaching-learning technique have been apparent in what I have said so far.*

1. Discussions may be kindled by brief objective tests.
2. A great many discussions are potential in the questions, problems, and other suggested activities of the study guide.
3. Demonstrations often lead to valuable discussions.
4. Many discussions are incited by questions and problems posed orally and extemporaneously by the teacher.
5. You can count on the students originating many discussions if they are encouraged to have questions ready at the beginning of the hour and to raise them at any time during the hour.

Discussion originates in and thrives on the question and the problem.

II. *Some of the common purposes served by discussion.*

1. The group serves as a stimulant to individual thought and effort.
2. Some problems of common concern may be solved more quickly and efficiently through cooperative effort, dividing the labor and pooling the results.
3. Alternate solutions to problems may be developed.
4. Particularly on debatable or controversial issues discussion brings out different sets of data and different points of view.

III. *Some types of discussion in common use as teaching-learning procedures.*

1. Involving the entire class simultaneously.
2. Involving a panel, and the remainder of the class as an audience.
3. Involving several small groups into which the entire class has been divided.
   a. Working on separate problems.
   b. Working independently on the same problem.
   c. Working on different aspects of the same problem.

IV. *Some toxic elements which commonly appear in discussion.*

1. Poor semantics. Failure to define realistically purposes and terminology.
2. Logorrhea on the part of one or more participants.
3. Teacher domination
4. Domination by an unduly aggressive student
5. The uninterested participant
6. The unprepared participant
7. The person who is afraid (Possibly of teacher criticism or teacher or class ridicule.)
8. Undue emotionalism (Usually in connection

with controversial issues).

V. *Antidotes for these and other toxic elements in the form of commonly accepted standards.*

A. *Standards for the group leader.*

1. He should be chosen by the group.
2. He should not feel that he must impress his views on the group.
3. He should help the group develop and accept a goal or goals toward which to work.
4. With the consent of the group, he should avoid profitless digressions.
5. He should have agenda in advance of each meeting.
6. He should supply reports of progress.
7. He should encourage contributions from each member of the group.
8. He should begin and close meetings on time.
9. He should not try to give the group the "right" answer in order to save time.
10. He should try to summarize progress from time to time, or ask a member of the group to do so.
11. He should support the rules of polite conversation rather than rules of order.
12. He should not try to get more done than can be done well in the time available.

B. *Standards for the individual member of the group.*

1. He should think for himself.
2. He should speak briefly and conversationally.
3. He should avoid talking more than his share of the time.
4. He should ask for clarification of terminology or arguments he does not understand.
5. He should speak out when he disagrees.
6. He should not regard discussion as a debate, but rather should look for the common ground on which agreement may be reached.
7. He should recognize that the group is always potentially superior to any individual in it.
8. He should welcome an opportunity to try to state an opponent's argument, or to have his own argument stated by an opponent.

VI. *Group dynamics with its*

1. Pre-meeting planning,
2. Use of consultants,
3. Permissive leadership,
4. Use of role playing,
5. Question and answer,
6. Buzz groups,
7. Use of observers and recorders,
8. Use of communication sheets. feed-backs, progress summaries,
9. Use of post-meeting reaction forms,
10. Use of evaluation teams, and so on, has done much to increase the dividends from democratically organized and conducted discussion.

Seen as one of many intermediate methods that belong in a sound general method of teaching, and *not as the basis for a cult,* group dynamics has its role in teaching procedure.

METHODS OF LECTURE, RECITATION AND QUESTIONING OF QUIZ

These questions and accompanying bibliography are intended to serve two purposes:

1. To remind the interested member of the seminar of the points involved in the use of the lecture, of the recitation, and of questioning as teaching methods. Being thus reminded, the member of the seminar may want to do some reading or thinking about some of the points, prior to the seminar meeting. It is taken for granted that the "why" for, and the implications of, each answer will be considered.

2. To indicate to other discussion leaders what we are likely to discuss under the headings named.

The discussion leader in connection with the topics just named, expects to show how the good points of lecturing and questioning may become integral parts of a valid general method of teaching. Whatever materials he prepares for this purpose he prefers not to hand out until the day of the discussions.

I. *The Lecture Method*

A. Lecturing, Telling, and Talking.

1. Do you distinguish between lecturing and telling as teaching techniques?
2. Is talking a teaching technique? Is it the same as lecturing?

B. Major and Minor Purposes Served by the Lecture as a Teaching Technique

1. Is the lecture well-suited for the purpose of inspiration and/or motivation of students?
2. Is the lecture well-suited for the purpose of summarization and/or review?
3. Is the lecture justified in part at least because:
   a. It sets standards for the improvement of the students' oral English?
   b. It helps students develop the ability to take notes?
   c. It helps students develop the ability to listen?
   d. It is effective in influencing the development of attitudes?
   e. It economizes the time of teacher and students?

C. Preliminary Planning for a Lecture.

1. How do you adjust the scope of the lecture to the time available?
2. Should the lecture be written in full? If so, should it be read to the class?
3. Should notes be prepared? In what form and how should they be used?
4. Should you plan in advance of delivery, the points at which questions and comments from students should be invited?
5. Should you plan to use illustrative material—audio-visual, demonstration, and others?
6. Should you attempt to introduce humor into the lecture?
7. Should the lecture be memorized and delivered verbatim?

D. The Lecture in Relation to the Specific Class
   1. What, if anything, does the existing rapport (or lack of rapport) between teacher and class have to do with the use of the lecture method?
   2. In general, how is the effectiveness of the lecture method related to:
      a. The chronological ages of the students?
      b. The intelligence of the students?
      c. The experiential backgrounds of the students?

E. The Lecture in Relation to Phases of Teaching Method Employed.
   1. How should the content of lectures be related to the content of reading materials available to the students in the course?
   2. How should the lecture be related to the study-and-activity guide for use of students in the course?
   3. What other teaching methods, techniques, and procedures, in addition to the lecture, should be employed?
   4. Is lecturing regarded as a relatively easy teaching procedure?

F. What are the characteristics of a good lecture?
   Have you ever heard a lecture that rated A-1 on each characteristic?
   Did you ever deliver one such?

II *Methods of Recitation and Questioning or Quiz*

A. The Recitation.
   1. Its origin and distinguishing characteristics.
      a. What system of education was mainly responsible for the development of the recitation as a general teaching method?
      b. What does the term recitation literally mean? Semantically, is it a good term to describe what is actually done?
      c. Is teaching from a single textbook an essential feature of the recitation method?
      d. Is the hearing of lessons an essential phase of the recitation?
      e. Is the recording of a daily mark for each student a logical part of the method of the recitation?
      f. Does the recitation put a premium on rote memory? Is that good or bad?
   2. Its efficiency and validity.
      a. Does the recitation result in economy of time for the teacher? For the student?
      b. Is the recitation teacher-centered or student-centered?
      c. How does the recitation provide for individual differences among students in aptitudes, abilities, aims, and needs?
      d. How would you rate the recitation as a means of educating students in the values and processes of cooperation, responsibility, initiative, originality, and problem-solving or thinking ability?
      e. How would you rate the recitation as a means of directing the study activities of the students in any given class?
      f. How does the recitation educate students in democratic group processes—not only group discussion, but group efforts at problem-solving in all areas of common interest and need?
      g. Is the recitation a good preparation for better daily living?
      h. In the light of your answers so far, what is the place of the recitation in a good general method of teaching?

B. Questioning or Quiz
   1. As it pertains to the recitation.
      a. Does the recitation necessarily involve oral questioning?
      b. Is oral questioning in the recitation mainly a testing procedure? Solely a testing procedure?
      c. What are the criteria of a good educational test? How does oral questioning rate in terms of these criteria?
      d. Does the typical recitation involve too few or too many questions?
   2. As an integral part of a valid general method of teaching
      a. What purposes may be served by good questions? Must questions be oral, in connection with a recitation, to serve these purposes?
      b. What are the characteristics of a good question?
      c. How are good questions related to the teacher's
         (1) capacity to think?
         (2) command of the field of the course?
         (3) capacity to express himself in clear, explicit English?
         (4) knowledge of what the students already know?
         (5) knowledge of the immediate needs of individual students in the course?
      d. How should the instructor deal with questions raised by the students?
      e. Should the oral question be used to rouse the inattentive student?
      f. Should the teacher ask "catch" questions?
      g. Should the teacher ask "leading" questions?
      h. Should the teacher repeat his questions?
      i. What standards would you recommend for a student's response to an oral question?
      j. What standards would you recommend for a teacher's treatment of a student's answer?
      k. What degree of formality or informality on the part of the teacher, do you recommend in oral questioning?
      l. Consider fully the pro's and con's of writing out the most important questions and suggested activities in connection with any topic to be studied — and reproducing them as an integral part of a mimeographed study and-activity guide given to the students at the outset of study of the topic. Would such a procedure eliminate the necessity and/or desirability of oral questioning?

Selected Readings[1]

Thayer, V. T. *The Passing of the Recitation,* D. C. Heath and Company, Boston, 1928.
Recitation: pp. 1-45; 161-166

Butler, Frank A. *The Improvement of Teaching in*

Frederick, Robert W., Clarence E. Ragsdale, and Rachel Salisbury, *Directing Learning*, D. Appleton-Century Company, New York, 1938
Recitation: pp. 166-179
Lecturing: pp. 373-378

Stiles, Lindley J. and Mattie F. Dorsey, *Democratic Teaching in Secondary Schools*, J. B. Lippincott Company, Chicago, 1950
Recitation: p. 80
Secondary Schools, The University of Chicago Press, 1939.
Questions and questioning: pp. 189-207

Douglass, Harl R. and Hubert H. Mills, *Teaching in High School*, The Ronald Press Co., New York, 1948
Recitation: pp. 180-182
Questioning: pp. 259-268
Lecturing: pp. 228-242

Thut, I. N. and J. Raymond Gerberich, *Foundations of Method for Secondary Schools*, McGraw-Hill Book Company, New York, 1949
Recitation: pp. 150-152
Questioning: pp. 162-164
Lecturing: pp. 81-82

Risk, Thomas R. *Principles and Practices of Teaching in Secondary Schools*, American Book Company, New York, 1941
Recitation: pp. 353-355
Questioning: pp. 515-537
Lecturing: pp. 378-385

[1] The first two years of college are secondary-school years.

TUESDAY DISCUSSION

Q: In classes where group discussions are advisable, would it be better to divide the 'A' students into groups, the 'B' into groups, etc., or is a heterogenous grouping best?

A: It depends on the purpose of the discussion. If it is a discussion where you desire many different points of view, then a more heterogenous grouping might be desirable, but if it is a type of discussion say for remedial measures, specifically for the slower student, or on the other hand with so-called 'extra reading', where material is covered, over and above the actual course work required, then it would be advisable to divide the class into the ability type grouping.

Q: Are there any places in pharmacy teaching where group discussion might be desirable?

A: I should say definitely yes. If of course you are studying for instance the characteristics of some chemical grouping, there is little need for group discussion. In the field of ethics, I believe it would be of extreme advantage to use the discussion type of learning. Also it has been found to be extremely useful in the pharmacy orientation type course, and also by a few teachers in their dispensing pharmacy courses.
In pharmacy dispensing it can be used to advantage by posing a question of a general nature to the students, giving them time to prepare their ideas, and at the next meeting of theclass, dividing them into groups and letting them discuss the many aspects of the problem. Let them select group leaders and report to the class.

Q: In large pharmacy classes, say of 100 or so students, it would be next to impossible to break the class down into groups of 5 and 6 students, as has been suggested. Would there be any benefits that might be derived if it were only feasible to divide the class into groups of 20 to 25 students?

A: The groups of 5 or 6 mentioned earlier were desired for drill groups to talk over the content of a reading assignment, or to discuss the meaning of words, not for true discussion grouping. In discussion grouping, if conditions made smaller groupings not feasible, larger groups can be used advantageously, even though this size of grouping is not as desirable. This method can be used for instance, in the laboratory where a certain experiment has several possible procedures. It might be useful to the instructor to have certain students study one or more of the possible procedures, then have discussion on the merits, etc. of each method at the next meeting.
The group discussion method in some classes probably can best be used only 4 or 5 times during a semester. If nothing else. it can be used to break the monotony of the laboratory and the lecture. The important thing to remember is to try and fit the teaching technique to that which is to be learned.

Q: Discussion techniques do not lend themselves to the teaching of factual material, as we find in much of our science teaching and of course even in the lecture method is subject to much criticism also. What are some of the other possibilities that you might offer?

A: I should say the possibilities are unlimited. Among them, are outside reading, putting on demonstrations, conducting experiments, making oral reports, making written reports, and the many possibilities afforded in reports of a primarily motor nature. It should be remembered that a sound general method of teaching doesn't depend on any of these things, but it tries to secure a happy intergration of oll. In teaching of facts probably all of the techniques can be used to great advantage, because a fact can not be learned by a single exposure to any one of the abov epossibilities. No student ever got a true understanding of 'why' anything happened merely by observing a demonstration or participating in a laboratory exercise. Both are important and necessary before a narrative kind of discussion should be included. In the laboratory the student can observe the 'what' and the 'how', in discussion with the class we can talk about the 'why'. And maybe some of that 'why' will have to be a result of a narration on the part of the teacher, reading the text, references, visual aids, and by talking about it.
It should be remembered that as many devices as possible, all dealing with the facts, are necessary for a good job of teaching. Factual material is often best taught by repetition, as we all know. Actually this is what takes place in group discussions, where the student not only hears something, but also has a chance to say it himself. There is a great need in the teaching of factual

material, in which so much of our pharmacy training is involved for better methods, and that is why group discussion is a partial answer. But we should remember that the best method is one where the student remains active and *he* is doing the thinking.

Students learn by problem solving and of course this is thinking. And our duty in teaching is guiding and directing this problem solving. Discussion, reading and demonstration sometimes help, as well as lecture, audio visual aids, etc. Don't limit your method to any *one,* of these methods, but integrate them as well as possible, under the circumstances. When students have done problem solving, they are learning, and of course thinking, and this is the important thing.

THE PURPOSE AND CHARACTER OF LABORATORY INSTRUCTION

By

DAVID J. BLICK

Assistant Professor of Science Education

University of Connecticut

HISTORICAL SETTING

In order to appreciate and understand the significance of laboratory instruction in higher education, it is necessary to go back several hundreds of years in the history of institutions of higher learning.

In the early years of the seventeenth century, laboratory instruction was beginning to take root in European Universities. Johannes Hartmann of the University of Marburg is credited with offering the first practical exercises in chemistry in 1609 and with setting up the first university chemistry laboratory.

> " . . . . . in which his students also were allowed to work, but only for the making of pharmaceutical preparations . . . . . " (18)

However, it was not until the early eighteen hundreds that modern laboratory instruction was offered: in Göttingen (from 1806 under F. Stromeyer); in Landshut (from 1807 under J. N. Fuchs); in Jena (from 1811 under J. W. Fisher).

Instruction in the natural sciences has been offered in American colleges for over three hundred years. Astronomy and the "Nature of Plants" were offered at Harvard as early as 1690 (1). During the eighteenth century Yale, Princeton, Columbia (then King's College), all offered work in natural history which covered physics, chemistry, geology, astronomy, as well as botany and zoology (15). By the middle of the nineteenth century, instruction in the natural sciences became a very definite part of the college curriculum. The various sciences were being differentiated from each other, and separate courses were beginning to be offered in each. The first professor of chemistry in this country was appointed in 1768 at the College of the Province of New York (2). Chairs of chemistry were established at Princeton in 1795, at Columbia in 1800, at Yale in 1802, at Bowdoin in 1805, at South Carolina and at Dickinson in 1811, at Williams in 1812, and thereafter at most other recognized institutions.

Although the science curriculum was coming into prominence during this period, instruction was almost entirely by lectures and demonstrations on the part of the lecturer. Very few laboratories were in existence and these were for the instructor and his assistants. Quoting from President Eliot of Harvard who wrote in 1904:

> "When I was a student in the Harvard College there was not a single laboratory open to the students in any subject, either chemistry, physics, or biology. The only trace of such instruction open to students was in the department of botany and that was only for a few weeks with a single teacher, the admirable botanist, Asa Gray, and he had neither apparatus nor assistants, and it was a hopeless job which he undertook for a few weeks in May and June. I was the first student who ever had the chance to work in the laboratory in Harvard College and that was entirely due to the personal friendship of Professor J. P. Cook, who fitted up a laboratory in the basement of University Hall, entirely at his own expense. That was the situation of the colleges in the country — for Harvard was by no means peculiar in this respect — only sixty years ago" (13).

One of the early efforts to include laboratory work by the student in the natural sciences took place with the establishment of Rensselaer Polytechnic Institute in 1825. In its science program, students were required to lecture and perform experiments before the class as part of the required course work. The establishment and rapid growth of the land grant colleges and universities with emphasis on practical applications to agriculture increased greatly the use of laboratory work as a means of training the student, but it was not until the beginning of the twentieth century that individual work on the part of the student became common.

The first published catalog of the then Storrs Agricultural School states: "The first term, the Juniors spend four hours per week reciting Chemistry. It is sufficient time to enable them to learn how to make the different elementary gases; in fact to acquire a good understanding . . . . . " (25). It is not clear from the schedule how many hours were devoted to laboratory. However, by 1903 the pattern had been clearly established. In the course description of General Chemistry is found: "Two hours of lecture and two two-hour laboratory periods" (24). It is interesting to observe that this pattern was strictly adhered to until the fall of 1946.

During the last fifty years laboratory work has become one of the most important and commonly used procedures for instruction in science. "Science and experiment seem to have become almost synonymous terms" (19). Other areas of study outside of the natural sciences have also adopted the laboratory approach, and each year it becomes more widely used.

PURPOSE

In order to appraise laboratory work, it must be considered in terms of its aims and objectives, and to make an over-all inclusive statement of the aims of laboratory work in college science teaching is very difficult, if not impossible. Institutions have developed

more or less independently and have built their curricula to meet their varied objectives, and they have never been standardized to the extent of our secondary schools. This may well account for the paucity of articles on the fundamental problem of the function and place of laboratory instruction. However, there are at least four broad functions: first, liberal arts education (including general education); second, professional training (preparation of teachers, nurses, etc.); third, highly specialized or technical training (training of engineers, chemists, pharmacists, etc.); and fourth, the training of laboratory technicians for specific routine jobs.

The problem of providing courses which meet the needs of all types of students in a college or university is difficult and often an administrative impossibility. However, it is now common to differentiate between courses taken as general education and those taken as preparation for further specialization. President Eliot said, "There are then two quite distinct functions which school and college laboratories perform. They tend to raise the observational powers of the average, and they give a chance to men of remarkable capacities to develop these capacities" (14).

Many laboratory manuals state that the purpose of laboratory instruction is to bring the student in actual contact with the material studied. This enables the student to obtain a knowledge of the subject that mere study alone cannot furnish. Other contributions of laboratory work frequently listed are: development of manipulative skill; development of self-reliance and ingenuity; training in the accuracy of measurement and the interpretation of experimental data; training in the writing of satisfactory reports; satisfaction of curiosity; and the cultivation of scientific attitudes and an appreciation of scientific method through experimental investigations. It should be borne in mind that much that has been written about the scientific method is sheer verbalism, and that the scientific method does not follow a series of steps but consists of the use of innumerable and almost unclassifiable techniques. Hurd (17), in a study published in 1929, lists forty-three functions of laboratory work in sciences as offered by thirty-five science instructors at the University of Minnesota. Some of the functions mentioned include: to give skill in using the scientific method, to develop manipulative skill, to aid memory, to develop power of observation, to teach the student self-confidence, etc. It is interesting to note that nineteen of thirty-three teachers felt that these abilities could not have been developed by any procedure other than laboratory work, while twelve of thirty-three teachers thought they could be developed by other than laboratory procedures.

Much of what has been mentioned in the previous pages applies particularly to beginning or introductory courses. Advanced courses may well have certain aims peculiar to them which will determine their purpose and which must be left to the judgment of the instructors who teach them.

THE NATURE OF LABORATORY WORK

Laboratory work in its broad senses implies "learning by doing". Certainly this concept is in accord with the currently accepted theories of learning and has much psychological foundation (10). However, it is important to remember that laboratory work should be conceived as a means to an end and not an end in itself. Too often much laboratory instruction is routine, laborious, and uninteresting. "Much of the laboratory work done in our present system is open to serious criticism because in many cases it consists of little more than a pupil going through a set of motions following directions of a "cook book recipe type" (16). There are, of course, certain special situations which may warrant the use of "cook-book" procedures especially in the training of personnel for specific routine tasks. This method was used very successfully during the last war, but it has little or no place in college level work.

Good laboratory work should be motivated by a real need and embrace the spirit of discovery. It should awaken a keen interest in both students and teaching staff. It should be an integrated part of the course work, and its relationship to the course should be clear to the student. It should involve both qualitative and quantitative aspects depending upon the particular problem at hand. And the attitude of the instructor is probably of crucial importance since it in large part determines the "atmosphere and climate" of the laboratory (9). It is he who determines whether or not the laboratory work will achieve its purpose, or whether it will become dull and routine. Unfortunately, much laboratory work is conducted on the basis of the deductive-descriptive approach as represented by the typical published laboratory manual. In the deductive approach, the student starts with a principle and makes observations or performs experiments to verify what is already known. All too often the student can complete the exercise more accurately outside the laboratory. And unknowingly, instructors may be encouraging intellectual dishonesty by demanding too precise results. Many students begin their laboratory work with enthusiasm, but soon lose it when they must get the results expected rather than observe what is really going on.

In contrast to the deductive-descriptive, the inductive-deductive approach implies using observed data to arrive at a more general principle which is then used in solving specific problems. "By inductive teaching is meant progressing from the particular to the general or more specifically from facts to concepts and principles" (23). The laboratory period is used to gather data. Properly used, it can be a challenging experience. Unfortunately, this calls for greater expenditure of effort on the part of both the pupil and the instructor, and it takes time. And there are few if any published college laboratory manuals which employ the inductive-deductive approach. Fortunately, many of the standard laboratory exercises can easily be reworded in problem form so that this approach can be used.

It is not to be implied that all laboratory work should be inductive. There is not time to rediscover all that has been discovered in the past; but a proper balance in the use of inductive and deductive procedures is needed. Bayles (5) has recently written a provocative article, "Is Modern Science Inductive", covering this very point.

Since the inductive-deductive approach requires

more time, it leads directly to the problem of what proportion of the time allotted to a course should be devoted to laboratory work. A review of college catalogs indicates that the amount of time devoted to lecture and laboratory in science classes varies considerably. No studies have been found to indicate that there was any sound reasoning underlying these patterns. Local tradition or the whim of the instructors apparently is a determining factor.

Bowers reported a study of the importance of laboratory work as compared with textbook work:

> Students are allowed to take the textbook work for two recitation periods per week, with the privilege of taking laboratory work for one double period per week, and receiving four credit hours for one quarters' work in the course . . . . .
>
> . . . . . The two hour workers averaged 81.2 per cent and the four hour workers averaged 85.7 per cent. This gives a difference of 4.5 per cent in favor of the four hour workers. Since the four hour workers spent twice as much time in the laboratory and one-third more time on the subject as a whole, it might seem as though the last twenty-five per cent of the time was unprofitably spent. (8)

Noll has reported on the results of an experiment involving individual laboratory work versus oral quiz and recitation. In this study a combination of oral quiz and recitation was substituted for some of the laboratory work regularly scheduled in courses in general chemistry at the University of Minnesota. He concluded that:

> There is no evidence here to indicate that Group III-b was done any injustice by being given an hour of recitation and deprived of two hours of laboratory work. If it lost through this change in method of instruction, other measures must be devised to show it. (20)

While the group having the oral quiz or recitation was superior in most cases, it did not differ from the control group by a statistically significant amount.

Noll has also reported on the results of an experiment involving two groups having identical instruction excepting the number of hours of individual laboratory work. These two groups had the same three lectures per week, but Group IV-a had five hours of laboratory work per week – a two-hour period and a three-hour period, while Group IV-b was excused from the two-hour period. He concluded:

> Of forty-two differences between means . . . . . thirty-eight favor Group IV-a and only four favor Group IV-b. None of these differences is significant . . . . .
>
> . . . . . In summary it can be said that when two groups were compared on measures of final achievement, after two quarters of instruction that were identical except for the amount of laboratory work, the group having the more laboratory work was consistently superior in mean achievement and somewhat less consistently the more homogeneous of the two. (21)

Ahmann has reported on a study conducted at Iowa State College. Students in one group were taught by the recitation-laboratory method which consisted of six contact hours per week divided into three two-hour periods. Students in the other group were taught by the lecture-recitation-laboratory method which consisted of two one-hour lecture periods, two one-hour recitation periods, and one three-hour laboratory period. The mean score on the final examination for the recitation-laboratory group was 77.12 while the mean score on the same final examination for the lecture recitation-laboratory group was 80.22. While the difference between the means is not statistically significant, the author concluded that:

> . . . . . The two methods for teaching introductory chemistry to freshman students in engineering were considered to be equally satisfactory. Although the statistical analysis indicates the foregoing conclusion, the Chemistry Department considered many features of the recitation-laboratory method so desirable that they have been incorporated into the teaching methods of many freshman classes. (4)

Blick (6) reported a study comparing three schedule patterns in teaching General Chemistry involving different amounts of laboratory and lecture work. It was found that one three-hour laboratory period was superior to two two-hour laboratory periods.

SUMMARY

Laboratory instruction began some three hundred and fifty years ago in Europe. In America it was used as early as 1825, but it did not become prominent and widespread until the beginning of the twentieth century. During the past fifty years, it has been adopted by many fields outside of the sciences.

Very little has been written about the purpose and function of laboratory work on the college level. However, some major purposes can be identified, namely: to bring the student in actual contact with the material studied, to develop manipulative skill, to develop self-reliance and ingenuity, to give training in accuracy of measurement and in the interpretation of experimental data, to develop an appreciation of scientific method.

Laboratory work implies "learning by doing". Good laboratory work should be a means to an end, and should awaken interest on the part of both student and teacher. It should be well integrated with the course work, and with proper balance between inductive and deductive teaching it should train the student to observe, to think, and to perform.

LITERATURE CITED

(1) *A Program for Teaching Science,* Thirty-First Yearbook, Part I, Public School Publishing Co., Bloomington, Illinois, 1932, p. 306.
(2) *A Program for Teaching Science, Ibid,* p. 307.
(3) Adams, C. S., "The Importance of Laboratory Work in General Chemistry at the College Level", *Journal of Chemical Education,* 19, June, 1942, pp. 266-270.
(4) Ahmann, J. S., "A Comparison of Teaching Methods", *Journal of Chemical Education,* 26, August, 1949, pp. 409-410.
(5) Bayles, Ernest S., "Is Modern Science Inductive", *The Science Teacher,* 21, April, 1954, pp. 113-116.
(6) Blick, D. J., "Three Schedule Patterns in Fresh-

man Chemistry Teaching", *Journal of Chemical Education,* 30, July, 1953, pp. 366-367.
(7) Boeck, C. H., "Teaching Chemistry for Scientific Method and Attitude Development", *Science Education,* 37, March, 1953, pp. 81-84.
(8) Bowers, W. G., "The Importance of Laboratory Work as Compared with Textbook Work in the Study of Chemistry", *School Science and Mathematics,* 24, June, 1924, pp. 606-613.
(9) Brandwein, P. F., "Unscientific Method in Science Teaching", *Science Education,* 30, April, 1946, pp. 158-159.
(10) Burton, W. H., *The Guidance of Learning Activities,* Appleton Century Crofts, 1952, pp. 4-26.
(11) Curtis, F. D., "A Plea for Inductive Teaching", *The Science Teacher,* 17, December, 1950, pp. 222-224.
(12) Ebaugh, N. C., "Laboratory Instruction in an Engineering Curriculum", *Journal of Engineering Education,* 38, May, 1948, pp. 659-662.
(13) Eliot, Charles W., "Laboratory Teaching", *School Science and Mathematics,* 6, November, 1906, pp. 703-707.
(14) Eliot, Charles W., *Ibid.,* pp. 703-707.
(15) Graves, F. P., *A History of Education,* Macmillan, New York, 1914, pp. 346-347.
(16) Heiss, Obourn, and Hoffman, *Modern Science Teaching,* Macmillan, New York, 1950, p. 163.
(17) Hurd, Archer W., *Problems of Science Teaching at the College Level,* The University of Minnesota Press, Minneapolis, Minnesota, 1929, pp. 9-10.
(18) Lochemann, G., and Oesper, R. E., "Friedrick Stromeyer and the History of Chemical Laboratory Instruction", *Journal of Chemical Education,* 30, April, 1953, p. 203.
(19) Noll, V. H., *Laboratory Instruction in the Field of Inorganic Chemistry,* The University of Minnesota Press, Minneapolis, Minnesota, 1930, p. 1.
(20) Noll, V. H., *Ibid.,* pp. 69-87.
(21) Noll, V. H., *Ibid.,* pp. 93-94.
(22) Schlesinger, H. I., "The Contribution of Laboratory Work in General Education", *Journal of Chemical Education,* 12, November, 1935, pp. 524-528.
(23) *Science Education in American Schools,* Forty-sixth Yearbook, The University of Chicago Press, Chicago, Illinois, 1947, p. 49.
(24) *The Connecticut Agricultural College Catalog,* Storrs, Connecticut, 1903, p. 78.
(25) *The Report of The Trustees of the Storrs Agricultural School,* Mansfield, Connecticut, 1883, p. 15.

METHODS OF INSTRUCTING AND DIRECTING STUDENTS IN THE LABORATORY

GEORGE L. WEBSTER

Professor of Chemistry

University of Illinois

The general objectives of the instruction in colleges of pharmacy have been stated very well in the "Findings and Recommendations of the Pharmaceutical Survey". I shall not repeat them here but will assume that each of you has his own understanding of those objectives. What is pertinent to these discussions today and this week are the ways in which these objectives may be accomplished within the minds of our students.

The process of teaching pharmacy to students of pharmacy is probably no different than that of teaching any other professional competence to any other group of students. It consists of a transfer of the accumulated knowledge and experiences of preceding generations to the present generation in such a way as to stimulate them to a creative approach to the new or unsolved problems which they will encounter during a long lifetime of practice.

Just as each of us has his own personal evaluation of the purposes of pharmaceutical education, so each of our students achieves his professional skills and attitudes in an individual way although instruction is presented to him as a member of a group.

The transfer of ideas from teacher to student takes place in part through the printed words in the textbook, in part through the spoken words of the teacher and in part through the personal experiences of the student. We are accustomed to calling the first two parts didactic instruction and the latter part, laboratory instruction.

In some subject matter courses we commonly consider that instruction is by didactic methods only. I believe that this is not true in as many cases as might be assumed. Most ideas have to be tested in some sort of practical way before they become useful tools with which to work. The laboratory for mathematics is the daily drill on problems, for rhetoric it is the weekly story or exposition, for the humanities, it is the class, the fraternity and the community.

In determining whether a given course should be accompanied by laboratory experiments one should examine the subject matter and the general objectives of the course. If the course is concerned only with definitions, classifications and correlations, the didactic approach will usually suffice. If the subject matter includes a study of natural phenomena and the development of experimental techniques, a laboratory course is indicated.

Laboratory instruction in the sciences and the applications of these to the professions comprises some planned series of situations which are intended to illustrate the ideas and theories advanced by the textbook and the teacher. Whenever the concepts or the techniques can be made understandable by physical demonstrations, it is usually worthwhile to provide such practical experiments. Fortunately, it is possible in many instances to illustrate principles with relatively simple experiments.

In fact, good teaching depends largely on the skill of the teacher in simplifying the presentation so that the principle can be comprehended in terms of observable reactions and the past experience of the student. Thus, it would not be helpful to set the average student down before the picture of a modern installation for the commercial recovery of penicillin and expect him to understand how penicillin is prepared for market. But after the student has carried out liquid-liquid extractions, reduced pressure distillations, freeze drying operations, air sterilizations and sterile transfers in single stage operations, the combination of these in a commercial process is understandable. At times, there may be some danger of over simplification, but if the simplified principle is fully comprehended, the variants may be understood with some additional effort.

Productive teaching by the laboratory method requires the use of as many of the available aids to understanding as can be applied. The most commonly used aid to laboratory work is a well written laboratory manual or textbook. In the basic sciences of physics and chemistry there are many such from which to choose. The problem is to select the one which is well prepared and contains the experiments which the teacher has determined will best illustrate the principles of the course.

In addition to simple and clear directions for assembling the apparatus and carrying out the experiment, a good laboratory manual should include a discussion of the principle involved in the experiment. This may be written for the individual experiment or it may take the form of a general presentation accompanied by several experiments each illustrating the principle. Often, the necessity to keep the manual small and reasonably priced dictates that these discussions of principles shall be very brief. In such cases the teacher should elaborate upon them in a lecture or discussion class.

In most cases, a well tested laboratory description needs no repetition or elaboration by the teacher. It has been my experience that, if the procedure involves potential danger to the student or to equipment, attention should be called to the possible danger and to the approved technique for minimizing it. A demonstration is frequently most effective in such in-

stances. Demonstrations by the teacher are also effective when the student is expected to acquire a new or complicated technique, to make the most efficient use of time, to obtain suitable data for later evaluation or to produce a suitable product. It is frequently true that the written or spoken description of a process may be complete and yet convey no real understanding of how it is carried out until it has been observed at least once. This is particularly true when the description concerns the use of an instrument or a piece of equipment which is unfamiliar to the student. In many cases, the demonstration needs to be a personal one or at most to a small group of two or three students. Examples of procedure which need personal demonstrations are the use of refractometers, polarimeters, spectrophotometers, flame photometers, catalytic hydrogenators, pressure autoclaves, vacuum stills and titrimeters, to mention only a few. At more elementary levels even such relatively simple techniques as determining indicator end-points, the use of an analytical balance, crystallization of compounds from volatile and flammable solvents are not techniques which are instinctive; they all have to be acquired. The good teacher tries to recall the difficulty with which he acquired his own skill and endeavors to bridge the gaps for his students.

Where the printed laboratory or textbook seems to present the directions inadequately, it is often helpful to supplement them with an elaboration prepared and presented in mimeographed form. If this becomes necessary for a large number of experiments, the teacher should decide whether to select a more adequate text or to write and have mimeographed all of the presentations. Occasional supplements can be effectively issued at the time needed. It is my belief that it is better to present the outline of the whole course at the beginning, if possible, than to issue daily supplements. If tasks are furnished only from day to day, the habit of looking ahead and planning work in advance cannot be acquired. Each days' work is likely to be viewed as an isolated unit and the continuity with the remainder of the course destroyed. This discontinuity can be prevented in a small measure by listing the topics and experiments to be covered during the teaching period and providing the students with this list at the beginning of the course. In this way, even though it is necessary for some reason to issue laboratory instructions in piece-meal portions, the student may know the extent and nature of the instruction to be offered and may measure his quantitative progress from time to time.

Although the laboratory manual may contain a presentation of the principles and adequate directions for the conduct of the experimental work it may be desirable and necessary in some instances to assemble the class at the beginning of a laboratory period for a discussion of the observations to be made and kind of data to be obtained during the experiment or for a demonstration of the technique of procedure. This pre-experimental instruction can be very helpful but it also can be over done. When the instructor talks to the class during or before a laboratory period, he should remember that his function is to clarify the meaning of the work which the student is doing, not to forecast results or figuratively speaking, hold the hand of the student while he does the work. A certain amount of waste motion is to be expected from all but a few of the members of the class. It is these latter few whom you should watch as potential graduate students.

Reference has been made to the need for small group or personal instruction in particular techniques especially where expensive and limited equipment is to be used. It is wise to estimate in advance the time which will be required to give adequate instruction in the use of such equipment. The teacher can then estimate the proper time during the semester or quarter in which to begin this personalized instruction so that each student may have an opportunity to participate. This means that the particular experiment will be completed by many students out of sequence. However, it is frequently possible to adapt the instrument in question to more than one experiment and in this way preserve continuity of experiments. Instruments like polarimeters, refractometers, visual colorimeters and analytical balances which require a measure of personal judgment in determining end points require personal instruction. The student may acquire the mechanics of their operation from group instruction or from textbook descriptions, but he needs to have his judgments confirmed by an experienced operator for the first few times in order to acquire the confidence to later work alone. For example, most textbook descriptions of the matched fields of a polarimeter describe them as being "equally illuminated" or "of uniform brightness". This is literally true, of course, but what is not sufficiently emphasized is that there are two such points, 180° apart, one of which is maximally illuminated and hence worthless for determining an end point and the other minimally illuminated and the only useful point for the analyst. It has always seemed to me that this end point should be described as being the position in which the matched fields are equally shadowed. Even if the textbooks properly described this end point the student needs confirmation of his observations for the first few times in order to acquire confidence.

The solo operation of high pressure equipment should never be permitted until the teacher has supervised a sufficient number of such experiments with the individual student to be convinced of his competence and trustworthiness. Some students should never be permitted to conduct experiments under these conditions without close and continuous observation by the teacher.

Instruments which indicate the end point of a reaction by dial readings or which record the progress of the experiment on a graph may usually be demonstrated to groups of students and then turned over for individual use under less personal supervision. Included in this group are photoelectric colorimeters, spectrophotometers, polarographs and pH meters. The use of motion picture film or film strips with close-ups of dials can be very useful for preliminary demonstration of such instruments to large classes but the instruments should be demonstrated to small groups before individuals are permitted to use them. Motion picture films are also useful in teaching the technique of weighing, titrating, filtering and washing precipi-

tates, fractionally distilling under ordinary or reduced pressure and the skills of fabricating dosage forms of medication. Some such films I have seen in practice and others, I should like to see.

One of the large problems in laboratory teaching is that of stimulating the student to a thoughtful study of the experiment at the time he performs it. Various devices have been used by good teachers, the most common one being a list of questions which the student answers during the course of the experiment. If the experiment involves the measurement of quantities and the calculation of a resultant, the direction sheet may require the solution to the problem.

The printed question technique is a useful device when there are a sufficient number of staff persons circulating in the laboratory to make sure that the observations represent the opinions and thinking of the individual student. Each staff member should be assigned to the supervision of a reasonable number of laboratory students and be responsible for their instruction. While circulating among his assigned group, he may inspect the notebook and by oral questioning determine if the written answers represent individual or group thinking. One of the better procedures when printed or mimeographed questions accompany the laboratory directions is to have them on detachable pages which may be answered, removed and handed in at the end of the period. Of course, if a laboratory manual is used in the same edition for several years, the percentage of correct answers appearing on the work sheets becomes higher and, understandably, the wording of the answers becomes more uniform. This points up the desirability of closer supervision in the laboratory or of more frequent changes in the laboratory manual.

When the tear-sheet laboratory report which must be completed before leaving the laboratory is used, the problem of copying last year's report is minimized. These sheets may be inspected, corrected and graded between laboratory sessions and returned to the student for his record.

Another type of report which can be useful for analytical laboratory reports is a mimeographed outline of a data sheet on which the student fills in his observational data, the equations for the reactions used, a calculation of the milliequivalent weight (if needed), the indicated calculation from the data collected and the resultant.

In our college we were driven to adopt this type of formal report in self-defense. Students in Drug Assay, when no form was provided, made their reports on sheets of paper varying in sizes. The information was always there, but seldom in the same order on any two reports and it seemed that it was easier on the teacher to provide the form than to decipher the handwritten reports of students. The original data contained in the student's notebook must be available for inspection at any time and is always referred to in cases of unacceptable resultant.

In another course in chemistry, a notebook of uniform size with permanently attached sheets is required of all students. On the completion of the determination, the student hands in the entire notebook with the data and calculations arranged in a prescribed form. The instructor or his assistant checks the accuracy of the resultant as well as the precision of the determination. In the event of any discrepancy, the observed data are at hand for a recalculation. The staff member accepts or rejects the report and returns the notebook.

In Physics and beginning Physical Chemistry, students usually work in pairs. In part, this is an economy of apparatus and in part results from a belief that it is good teaching. The philosophy of this is that the emphasis in these courses is on the principle and the proof of this by the experiment. The technique of experiments in these courses is either simple or it has been acquired in other courses. Also, it frequently requires the attention of both partners of a team, one to make the observations and the other to record the data. As a common practice, the laboratory period is devoted to the setting up of the equipment and the taking of data. At the end of the period, the data sheet and its copy are inspected and initialed by the instructor. Each student completes the calculations, makes the indicated graphs, drawings and comments and returns his copy of the data sheet with the completed report at the next meeting of the class. This makes for considerable paper work for the staff, but it seems necessary for good teaching.

In laboratory courses restricted to advanced undergraduate and graduate students other control and teaching devices may be used. In a course involving the synthesis of organic compounds which we use as a testing ground for prospective graduate students, we permit considerable freedom of choice among a group of syntheses. Each synthesis is evaluated by the instructor as to its difficulty and a numerical value is assigned to it. The list of suggested experiments is posted at the beginning of the quarter and completion is indicated when a pre-determined total of points is earned, such as 100 or 125. Should a student wish to carry out a synthesis not listed, he may justify his choice and permission will be given.

There is no laboratory manual provided for this course and the student is required to search handbooks, laboratory manuals, encyclopedic treatises and other sources for methods of synthesis. Having found plans of syntheses for the several steps, a flow sheet is prepared and presented to the instructor for discussion. When the instructor has checked the proposal and has indicated the availability of the materials, the student proceeds with the synthesis. The report required is a brief summary of the experiment including the literature source of each portion, equations, calculation of yield and observations of conditions of temperature, time, stirring, etc., which may have affected favorably or adversely the course of the reaction. Ingenuity of search, quality of product, and yield are considered in grading the students in this course.

As an auxiliary experiment, the student is required to prepare a few simple glass items which require him to work pyrex glass tubing. The principle of this is demonstrated but the fabrication must be individual work. As might be expected, this is one of the more popular experiments.

We have only applied this method of handling advanced laboratory students to the course in the synthesis of drugs. It works satisfactorily there and I see

little reason why an adaptation of the principle of self-selection and semi-independent experimentation would not be profitable in a course in pharmaceutical analysis for advanced undergraduate students.

The mechanical and written aids to laboratory instruction are necessary but they are not sufficient for the whole task. The personal touch in the form of supervision is an essential part of laboratory teaching. The number of supervisors which is optimum for the task depends somewhat on the nature of the course. For beginning students in general chemistry, qualitative analysis, quantitative analysis and organic chemistry, our experience indicates that one supervisor for each 15 to 17 students is adequate. For the more advanced courses taken by Junior and Senior students, a larger ratio of students to supervisors is permissible. When the number of students working at one time is relatively small, say up to 35, the supervisors may circulate throughout the laboratory. In large laboratory sections of 75 to 100 each, it is less confusing to assign certain groups of students to a supervisor and allow him to have major responsibility for their instruction. In all laboratory sections, regardless of size, a senior staff member should be charged with the overall responsibility and general supervision.

There is a great value to the personal supervision of laboratory work by a staff member. It is through these contacts that the teacher learns to know those intangible qualities of personality which differentiate the superior student from the indifferent and the resistant ones. The student also derives benefits from these personal contacts which affect, often times unconsciously, his present and future attitudes toward his profession and society. So important do I think these personal traits that I ask each of my colleagues who teach laboratory courses to fill out a score sheet on each of the students whom they supervise in the laboratory, at the end of their personal contact with that class. This sheet is placed in the departmental office and is referred to whenever a former student asks any member of the staff to write a letter of recommendation for him. The letter can then represent a composite judgment of qualities other than the scholastic record. A sample of this score sheet is attached. I make no claim to completeness or acuteness and the form is subject to revision from time to time. Others than I have found it helpful. It belongs in this discussion only because it is one of the records which one department in one college of pharmacy keeps on laboratory teaching.

When the classes are large, the senior staff member should have group meetings with the junior members of his laboratory supervising team to inform them of the type of supervision they are expected to give. This should include circulating among the group of students, observing their technique and correcting it where necessary, promoting safety and asking questions to test the understanding of the student. The last half hour of the laboratory period may profitably be spent in checking notebooks. In order that the assistants may develop a feeling for teaching, they should be permitted to make announcements, conduct demonstrations and in general, assume considerable responsibility for the conduct of their groups. In order to do this the senior staff member should instruct them in their responsibilities and require them to attend his lectures so that they may be aware of his educational philosophy. A share in the responsibility for side shelf reagents, standardized solutions and the like contributes to the sense of responsibility which is essential for good teaching. Requiring the assistant to participate in the discussion of the final grades in the course and in the personal evaluation sheets is an enlightening experience for the prospective teacher.

Now that the subject of grades has come up, a few words can be said about the place of the laboratory evaluation in the final grade. Opinions and practice vary widely among good laboratory teachers. Again, course objectives should be consulted.

If, as is the case in many beginning science courses, the laboratory work is chiefly to illustrate the didactic portion of the instruction, one may adopt the principle that the laboratory work must be completed or a grade in the course will not be given but that the grade in the course will be determined by grades obtained in written examinations and conference performance.

Courses after the introductory ones usually are designed to teach skills as well as principals. In such cases, it is my opinion that the laboratory work should be reflected in the final grade for the course. Fortunately, there are several criteria which can be used to help reduce laboratory performance to grades. Where quantitative results are obtained, the accuracy and precision of these may be used. This, coupled with the equally important attitudes of the student toward his work which may be judged from day to day by his supervisor, can readily be made up into a grade. In case the laboratory experiments are principally designed to develop skills, it is often customary to give separate examinations, either written or practical, to test proficiency in these skills. If the entire course carries five hours of credit and the laboratory comprises two periods each week, it seems reasonable that the laboratory grade might be forty per cent of the final grade.

In certain courses, we have counted the laboratory grade for as much as one-half the total grade and in other courses for as little as one-fourth of the total. It has always interested me that, whatever has been the proportion of the total assigned to laboratory work, the students who passed the course always performed reasonably well in both the didactic and laboratory portions of the course. There is usually a correlation between understanding of principles and ability to apply them. The occasionally cited student who is a genius in the laboratory and a dullard in the class room has never been a member of our classes. If a student is good in one of these aspects, he is usually good in the other; the lazy ones are lazy in both.

STUDENT SCORE SHEET

(To be filled in at the termination of the course)

Name: .....Course: .....

ABILITY			Check words which apply most closely
Above Average	Average	Below Average	
			Learning: without effort; with effort; slowly.
			Understanding of principles
			Correlation of theory and practice
			Transmission to teacher or others
			No opinion
			Comments:
PERFORMANCE			
			Work Habits: Works out own plans; needs some suggestions; requires a plan to be furnished; prefers to have a plan furnished; works best alone; works best with others; no opinion
			Technical Skill: No opinion
			Written reports: Well organized; clear; disorganized; must be reminded; promptly rendered; no opinion
SOCIAL HABITS			
			Other students: Popular; indifferent; unpopular; contentious; agreeable; no opportunity to observe.
			Teachers: Liked; disliked; no opinion
			Leadership: Seeks; accepts; rejects; no opinion

Is he recommended for further training in Chemistry? Yes—— No—— No opinion——

To what aspect of pharmacy do you think he is best adapted? Retail—Mfr.—Detail—Techn.—No opinion

Other remarks may be written on the back of this sheet.

WEDNESDAY DISCUSSION

Q: How many times should a student be required to repeat an experiment?

A: I believe that the student should be allowed to repeat something as long as he is enrolled in the class, but that this should be extra work and not at the expense of the rest of the exercises.

Q: When a student is made to repeat an experiment on whose time does he repeat the experiment?

Q: The answer is obvious to me. I believe that the laboratory should always be open to the sutdent so that he has every opportunity to repeat at his convenience.

Q: To what extent should the laboratory portion of a combination lecture-laboratory course influence the final grade?

A: It depends on the nature of the laboratory. In elementary courses many instructors do not allow the laboratory to contribute numerically to the grade, but in courses where development of a skill or the knowledge of various ways of doing things, and doing them carefully is part of the laboratory purpose, then I should say that some weight up to one-fourth or one-half of the grade should result from the laboratory grade.

Q: What do we do with say a senior student who demonstrates a lack of sufficient skill in dispensing pharmacy?

A: Is the student so poor that he would be a menace to society, or is he so poor that he is the worst in the class? I believe that this is a problem that should be taken up with the rest of the faculty. Actually he should have been weeded out long before this.

LABORATORY — REPORT AND EVALUATION OF STUDENT ACHIEVEMENT

MELVIN W. GREEN
Director of Educational Relations
American Council on Pharmaceutical Education

In preparing a paper on reporting and measuring achievement in the laboratory, I found it difficult to stay within the confines of the topic. On the one hand, one cannot discuss achievement testing in the laboratory without discussing the purposes of laboratory exercises and experiments; neither can the measurement of achievement in the laboratory be divorced entirely from testing in purely didactic programs.

If you will bear with me for a moment while I infringe upon my colleagues, I wish to recapitulate briefly the kinds of laboratory exercises and the reasons for them as I see them. The purposes are somewhat as follows:

(1) To learn or to develop a skill. Here we have such exercises as making suppositories, determining melting points, running a gravimetric analysis, cannulating a carotid artery and many others with which you are familiar.

(2) To "see" a chemical, physical, pharmaceutical, biological or economic principle. This might be illustrated by the handling of an eutectic mixture in dispensing, the use of the 4-2-1 principle in making an emulsion, the inhibiting of cholinesterase by eserine, extracting and quantitating an alkaloidal assay, producing polyploidy with colchicine, and many other examples. The goal of such exercises is to understand the principle and be able to apply it under diverse circumstances.

(3) To observe a fact or an idea to impress it upon the mind. Here we might cite the observation of a crude drug under the microscope, the observation that sugars are capable of reacting with phenylhydrazine and substituted phenylhydrazine to form osazones, the preparation of a scorbutic guinea pig and its cure with vitamin C – rich foods, or the observation that epinephrine can bring about a blood pressure rise in a dog.

(4) To learn to evaluate scientific data. While this is probably the acme of attainment for the scientist, it is important for the practicing pharmacist too. He will be forced to interpret scientific data on new drug developments after he is out of school and his success in doing so will be a measure of his success as a practitioner.

There are probably other factors that I could have mentioned and obviously, all of these factors may meet in a single exercise.

The method used to determine achievement in the laboratory should be related to the objectives of the exercise as well as the type of exercise. In measuring achievement one other factor, unfortunately, needs to be taken into account. The instructor must know whether the exercise was actually done. This is not a problem of the present generation (1) nor one unique to pharmacy (2).

There are many ways in vogue for establishing the fact that the exercise was actually one, although many types of exercises do not need such control. In organic chemistry, and its applied counterpart, organic pharmaceutical chemistry, the substance to be synthesized often has associated with it certain trace impurities which are always present in the laboratory method of production. Testing for these trace impurities (assuming them to be absent in a commercial product made under different conditions) often tells the tale. In some instances it is rather embarassing to admit that it becomes necessary to penalize a student for making a preparation that is too pure, yet it is true that there are exercises in which it is not possible to obtain the degree of purity on a laboratory scale that one attains industrially. Consequently a student who turns in a product of commercial purity is open to suspicion. Since students working in stores have been known to bring in commercially prepared pharmaceuticals to substitute for the day's exercise, the instructor can often get around this by placing some easily tested for trace substance in the excipient, vehicle or solvent. In some fields, such as pharmacology, unique records, difficult to fake, may be required such as a kymograph recording. In other areas like qualitative and quantitative analysis and, to a certain extent, pharmacognosy and pharmacology. the use of "unknowns" makes individual work mandatory. The use of individualized prescriptions accomplishes much the same thing in dispensing. Testing the student's knowledge about the exercise by oral and written quizzes often gives a clue as to whether the student did his own work. Closer supervision of the laboratory often can prevent "double batch" operators. Needless to say, in the interest of professional ethics, those caught using such techniques should be dealt with severely.

To test successful achievement in the laboratory depends on the type of exercise; in some cases it is no more difficult than didactic testing, while in other cases it presents special problems. One of the most troublesome type of exercise to evaluate may be represented by color and turbidity testing in the test tube, especially where it cannot easily be coupled with a systems of unknowns. Phytochemistry (whether a part of pharmacognosy or pharmaceutical chemistry) has a number of such tests which are deemed to be of value. Possibly one of the most effective ways of determining whether the student understands the principles involved is by means of a written test. The instructor may state the reaction of an "unknown" (to the student) substance to a series of reagents and ask the student what compound or class of compounds is

likely to be involved. I am sure you are all familiar with the series of precipitations or swelling tests applied to gelatin at different pH's in order to illustrate the isoelectric point of proteins. These tests in various laboratory manuals all stem from Jacques Loeb's original work. One could quote other data from Loeb's original work and ask the student to discuss its meaning. This has an additional advantage, for it gets back to an original and classic experiment. We need to remind ourselves that the origin of so-called scientific facts is an experiment not unlike the student's exercise – in fact if the study of great books is so sound educationally, why not the study and repetition of the great experiments?

Many of these more qualitative experiments can be rendered more quantitative and by doing so give them more meaning to the student and render them easier to grade by the instructor. Aside from those qualitative exercises involving making something (pharmacy, organic synthesis, etc.) most such experiments are supposed to illustrate a chemical, physical or biological principle. Therefore the thing to test is the student's grasp of the illustrated principle.

Many non-qualitative experiments as well as working traits such as neatness, speed, manual dexterity, frequently are measured on a quasi quantitative scale developed by the instructor. For example. in a student preparation in pharmacy that is supposed to have a light precipitate suspended in it, the instructor often lines up all of the student preparations and assigns a certain number, let us say 5, to those preparations having about the correct volume of suspended matter, a 4 to those having less, or more, a 3 to those having still less and possibly a 2 or 1 to those having a deficiency of magnitude. In using codes of this type it is important to keep in mind that these are codes and that the numbers do not usually bear the relation to each other that one expects in mathematics. That is, it does not necessarily follow, in these cases, that a 4 represents twice the value of a 2. The intent of the grader is to say something like this: "This product is as well done as can be done under the conditions in this laboratory, therefore I will state that fact in short-hand by assigning it a 4; the next product has the label crooked and is off color to a major degree, therefore I will express that fact by assigning it a 2. I wish to stress the code character of this type of grading. Strictly speaking, an average of such numbers has no meaning. I have seen instructors lose sight of that fact to the point that they were averaging the numbers from two or more exercises having different grading scales!

The value of a semi-quantitative scheme of this kind can be extended by the use of a profile even though one does make use of an illicit arithmetic mean, or some other measure of central tendency. Make a profile chart containing each of the laboratory exercises or preparations and each of the skills or qualities based on the class mean, median or mode (bearing in mind the significance of the figure thus used) and then plot the coded values for a single student on the same chart. Instead of a calculated standard, the standard may be the value the instructor expects the student to attain. This will show up the strengths and weaknesses of each student in a graphic fashion. One can weigh the various qualities charted and on this basis pass judgment on the student which may be more meaningful than more quantitative approaches. It certainly makes it easier to write a letter of recommendation.

Another way such coded values can be utilized is by converting them into more conventional grades. One can decide in advance that for a given exercise a coded grade of 4 shall be an A or a 90 or whatever value seems to be appropriate.

There are other semi-quantitative types of measurements that can be made also. I recall visiting one dispensing laboratory where tablet triturates of some very potent alkaloid were being made by the students. The instructor had devised a test whereby a tablet was added to a given volume of water and an alkaloidal precipitant added. The resulting turbidity was compared with a standard from which the approximate deviation could be determined easily and quickly. No doubt the grades assigned various tolerances were based on the degree of experience expected of the student at that point in his career.

Cost, time and other factors make it difficult to render some exercises quantitative that otherwise could be so done. Certain bioassays might be cited as cases in point. Nevertheless, each student could inject one dose level into one or more animals and the results pooled. This gives the instructor an opportunity to see how the student can interpret and manipulate a mass of data.

This brings us to more quantitative type of experiments, which are at least easiest for me to illustrate in terms of a quantitative analysis done by the student. In the case of most standard analyses such as gravimetric chlorides or volumetric acids, the accuracy that can be expected is rather generally known. Usually, however, accuracy expected is known in terms of the expert or at least experienced analyst. The accuracy to be expected of students can be determined by studying the results of several classes on carefully analyzed samples. The difference between the values found by the student and the expected values may be correlated with grades by any of several devices. Perhaps one of the most frequent devices is to correlate, statistically, the difference in terms of fractions or multiples of standard deviation units. Once a grading table is made the assignment of a grade based on accuracy becomes automatic. Precision can be treated in the same way. If you will pardon the personal reference to a past paper by the author, I should like to illustrate how this may be done (3). I am not claiming any unusual virtue for this method, but rather simply illustrating a method for arriving at a technique for a more quantitative and "scientific" type of grading.

Statistically it is recognized that in any series of measurements, deviations from the average figure is meaningless, but that the standard deviation, which is the sum of the deviations squared and divided by the degrees of freedom, can be interpreted more satisfactorily. Furthermore, it can be stated with assurance that one should expect about two-thirds of all data to be within the limits of the average figure $\pm$ one standard deviation unit, about 95 per cent of the data should fall within $\pm$ two standard deviation units and better than 99 per cent of the data should be with-

in ± three standard deviation units.

Since analytical data are expressed commonly to four decimal places, a calculation involving squares and squareroots becomes very cumbersome, especially when handling large amounts of student data. During recent years it has been recognized that when dealing with small samples, the range (the largest minus the smallest) is a measure of the dispersion as sensitive as the standard deviation and in fact related to it. This fact is the basis for statistical quality control in industry.

In a student laboratory, it is common to have many unknown samples whose values are known with some accuracy to the instructor. To collect and evaluate the data from such samples, it is necessary to express the accuracy in terms of the deviation from the known value. This makes it possible to compare the results of all students making the same determination even though different samples are used. In our laboratory the students run all determinations in triplicate, hence the calculations will be demonstrated on this basis.

First typical student values must be obtained. As each student turns in his results, record the deviation of his average from the known value and record the range (the highest minus the lowest of the three data). After the data from the entire class has been tabulated, calculate the grand average deviation (X) and the grand average range (R). The average range, R, is a valuable parameter from which a sound estimate of the standard deviation from a very large number of subgroups can be obtained. It is accepted that for subgroups of three, the ratio of the average range and the standard deviation is 1.69 and this ratio is customarily given the symbol d_2. The estimated standard deviation is then calculated by dividing the average range by d_2 (in this case 1.69). This measures the spread of individuals, however.

Averages can be expected to deviate within three times the standard error of averages (mean), this latter value being the standard deviation divided by the square root of the sample size, n. Tables are available which avoid these calculations by relating the range to the limits (statistically termed 3-sigma limits) directly. For subgroups of three, this value (in tables symbolized A_2) is 1.02. Therefore, if one multiplies the average range by 1.02 the dispersion of average deviations is obtained. This value added to and subtracted from the grand average of the class gives the upper and lower limits of average deviations from the known value to expect if the work is in control. When the average of any student's values goes beyond these limits, his accuracy in relation to his fellow students is sufficiently low that he should repeat the experiment.

Since standard deviations of subgroups, and hence ranges, are dispersed around the grand average of such ranges, the same statistical laws apply. For small subgroups the lower limit for the ranges is obviously zero and the upper limit may be obtained by multiplying the tabular value D_4 (again derived from ratios which convert to standard deviation units). For subgroups of three, D_4 is 2.57, i.e., the upper limit for ranges is 2.57$\bar{R}$. Table I gives the value of d_2, A_2, and D_4 for replicates of 2, 3, 4, and 5.

TABLE I

Replicate Size	d_2	A_2	D_4
2	1.128	1.88	3.27
3	1.693	1.02	2.57
4	2.059	0.73	2.28
5	2.326	0.58	2.11

The utility of this method can be illustrated by the alkalimetric determination of the purity of sodium carbonate using values obtained from 78 students. The determinations were made on 8 different samples. The average deviation from known values was 0.36 per cent and the average of the ranges was 0.42. expressed in percentage units. To find the limit for average deviations, multiply the range by A_2, i.e., 0.42 x 1.02 = 0.43. This value added to the grand average is 0.79, the upper limit for averages. That is, any student average which exceeds this value is completely out of control in relation to the other students. There were two such values in this lot of 78. Obviously there should be no lower limit on accuracy.

The upper limit for ranges should be D_4R or 0.42 x 2.57 = 1.08. If the range of the triplicate results of any students exceed 1.08 (in percentage units) his precision is so poor that he should receive no credit for the determination and should repeat the experiment. There were three such cases in the group of 78 reported. The value of this finding lies in the knowledge that the precision of these three students lies far beyond that of the rest of the class and is being set by his fellow-students and not by experts. Table II shows the ranges, average deviations, limits on accuracy and on precision of several typical laboratory experiments as well as the number of cases exceeding the limits. The number of students involved in the different determinations ranged from 70 to 90. Additional data are in the original paper.

TABLE II

ANALYSIS OF SOME TYPICAL STUDENT DATA

Reaction	average	range	limit of average	limit of range	Number beyond limit on accuracy	Number beyond limit on precision
Soda ash titration	0.36	0.42	0.79	1.08	2	3
Volhard chloride	0.40	0.40	0.81	1.03	3	6
KH Phthalate Titration	0.25	0.28	0.54	0.72	1	4

Many teachers do not believe that too much emphasis should be placed on precision at the beginning level, but rather the stress should be on accuracy and that the precision will come later as experience increases. This method allows one to segregate quickly the least precise for action. If one wishes to grade on precision, it is a simple matter to establish levels of R in relation to the standard deviation and develop a grading table. This is described below.

Statistical tables are available which relate the fraction or the multiple of the standard deviation unit to the area under the probability curve. For example, 0.25 of a standard deviation unit is represented by 19.6 per cent of the area, and 1.5 standard deviation unit represents 86.6 per cent of the area according to standard tables. The instructor can determine what percentage of his class should receive a particular grade. Since the majority of grades should be "C", standard deviation units can be picked to throw the majority of grades in the upper 70's and lower 80's. Since the standard deviation is related to the average range by being equal to $\bar{R}/d^2$, the standard deviation can be related to $\bar{R}$ in such a table.

In a given determination, the ranges obtained by individual students are assumed to be dispersed about the average range in the normal manner. This is not strictly true, but appears to be true enough for our purpose. On these assumptions, a table was constructed of grades (related to the area under the distribution curve) and a Range Factor, i.e., the multiplier of the average range $\bar{R}$. These values are found in Table III. Table III serves then, as the master table for determining grades for individual analytical determinations. For example the Range Factors for the grade of 78 per cent is 0.85 to 1.27 (n = 3).

TABLE III

RANGE FACTORS AND GRADES

Range Factor n = 2	Range Factor n = 3	Grade %
0.0 –0.57	0.0 –0.087	98
0.058–0.11	0.088–0.17	96
0.12 –0.17	0.18 –0.25	92
0.18 –0.19	0.26 –0.29	88
0.20 –0.28	0.30 –0.34	86
0.23 –0.26	0.35 –0.39	84
0.27 –0.28	0.40 –0.43	82
0.29 –0.55	0.44 –0.84	80
0.56 –0.84	0.84 –1.27	78
0.85 –1.13	1.28 –1.72	76
1.14 –1.23	1.73 –1.86	74
1.24 –1.35	1.87 –2.04	72
1.36 –1.45	2.05 –2.20	70
1.46 –1.56	2.21 –2.37	68
1.57 –1.68	2.38 –2.54	66
1.69 –1.79	2.55 –2.71	64
1.80 –1.90	2.72 –2.88	62
1.91 –2.00	2.89 –3.04	60
2.01 –2.13	3.05 –3.22	55
2.14+	3.23+	50

In the case of the titration of potassium acid phthalate, the average range ($\bar{R}$) for the classes was found to be 0.28. Multiplying the average range by the Range Factor gives an actual range for this grade of 78 per cent of 0.24 to 0.35, i.e., any student having a range of a triplicate determination between 0.24 and 0.35 (in percentage units) would receive a grade of 78 per cent for precision only. The instructor can then integrate this grade with one based on accuracy only in any way deemed proper. Table III contains also Range Factors for a subgroup of two for cases where the determination is made in duplicate.

To simplify, grading tables have been established for each determination in the course showing the ranges applying to each percentage and related to the class average determined from previous classes. As more data accumulates, it may be desirable to change the average range of that of several classes combined. Obviously when the instructor knows some definite numerical value which a student is expected to obtain in an exercise, he can use devices of this type which at least appear to be yielding more "scientific" approaches to a grading scheme.

One more word about grades and grading before passing on. I suppose nearly every teacher at one time or another has concluded that any grading system is mere academic bookkeeping and nothing more (4). What does it mean that he is precise, smart, that he worked hard? Does it mean that the student is an independent thinker or does it mean that he is a disciplined conformist? Frankly I don't know. One thing is relatively clear, however, and on the side of the bookkeepers. Every study that I have seen made to try to correlate success after graduation with school grades has shown some sort of positive correlation. In general, I have greater faith in the value of grades in terms of laboratory courses for it is in the laboratory where those who really love teaching put forth their greatest effort and where they get closest to the stuent.

II

The second portion of my assignment deals with laboratory reporting. After the student makes the laboratory observation, what shall he record and how shall he record it?

There seem to be two schools of thought here as in most teaching methods. The first school is the "fill it in on the dotted line school". You are all familiar with many laboratory manuals that use such a technique. The manual asks the question of the student. The student finds the answer in the laboratory and in supplemental reference works and places the answer in the proper place in his manual. Such reporting can have important advantages, especially for beginning students. It helps him to recognize his goal in the laboratory and, in many cases, it provides a simple way to organize the results of his investigation. There are those, however, who will argue that this method destroys student initiative. Certainly in a way it does. Personally, I would rather restrict the use of such manuals to the lower level courses.

It should be added that great care must be exercised in setting up such a manual in the first place. Ambiguity is difficult to avoid; manuals used by others than the original authors are especially apt to be troublesome. I have used several manuals and to the best of my ability to recall have always found a few such ambiguities. These cause considerable frustration by the students and not a little by the instructor.

The other technique of recording is a more descriptive one in which the student follows some preconceived outline. Such a recording should bring to the attention some or all of the following features regarding the exercise; the purpose, the materials, the organization of the materials, the observations, the results and the interpretation of the results in terms of the purpose of the experiment. A system of this type gives the student considerable chance to

use his initiative of expression. The reading of the student notebooks is time consuming and yet should be done critically with rather detailed criticism by the instructor. I fear that the method often falls down because so many instructors are as lazy as I.

In certain courses, such as quantitative analysis or drug assay, the student should be required to enter all details of an exercise promptly and directly into his notebook. This should include data such as weighings and buret readings as well as all calculations. No erasures should be permitted. In this way, complete check on the assay can be made in case of an error in the result. Since a few students will go into industry as analysts, this will be good training for them, for in industry one must be able to check back at all times.

At least once in the curriculum the student should have an opportunity to plan an experiment, execute it and write it up in detail in report form.

The recording of experiments and exercises to be of maximum help to the student should be corrected in detail by the instructor. Those who go into hospital pharmacy, industry as technicians, sales, and administrative pharmacy will have to write many reports. The quality of reporting is criticized by employers in our field, among others, to a point of major concern. In laboratory reports and notebooks are opportunities to assist the student to write better reports. There are many good books and articles available to stimulate better reporting.

No doubt the intent of this seminar is to restrict itself to undergraduate teaching, but it would appear to be necessary to comment briefly on record keeping by graduate students, particularly with respect to their researches. Most graduate students, after obtaining their degrees, go into research. Especially if it is industrial research, it is often necessary to establish priority for patent purposes and other legal purposes. It is imperative for the graduate student to be impressed with the necessity for recording all details of an experiment, no matter how trivial they may seem to be at the time. All pages in such a notebook should be dated, signed and preferably witnessed. I know of one industrial research organization which makes the requirement that each page of the experimenter's notebook must be signed, witnessed and dated. Such notebooks have found their way into the Courts and patent hearings upon many occasions.

Often the experimenter does not know at the moment whether a detail is of no consequence or is all important. I recall studying the ephedrine assay in the days before the volatility of ephedrine base was known. In some early tests I got good results which I was unable to reproduce later. Sometime later it became clear that in the initial experiments I had used 400-cc. tall beakers to concentrate an ether solution of ephedrine base. This type and size of beaker had been selected accidentally and without realization that it provided sufficient condensing surface to prevent loss of ephedrine by evaporation. Had this detail been recorded it would have saved considerable work later, yet at the moment it seemed to be of no consequence.

In summarizing these rambling remarks, it is obvious that there is no panacea or universal formula that can be used to give proper recognition of achievement in the laboratory nor is there a universal best way to report laboratory results. It seems to me that each of us should go home and study our laboratory courses in order to determine (1) the goals of the course as a whole and the goal of each individual exercise (2) the best way to record the results of each exercise in light of those goals and (3) the best way to measure the degree of achievement of those goals. Setting up our programs on this basis, we ought to help bring about a reasonably good job of laboratory teaching.

Literature Cited and Suggested Reading

(1) M. Perman, *"The Drug Store"*, The Citadel Press, 1954, N.Y.

(2) Stone, "Standards in the Laboratory Results Vs. Student Integrity", *J. Chem. Ed.*, 4, 620, 1927.

(3) Green, "Precision in Beginning Courses in Quantitative Analysis", *Am. J. Pharm. Ed.*, 15 401, 1951.

(4) Marshall, "What To Do About Grades", *J. Higher Ed., XXV*, 263, 1954.

(5) Frost, "Method for Grading Quantitative Chemistry Laboratory Determinations", *J. Chem. Ed.*, 3, 562, 1926.

(6) Heisig, "Reliability of Quantitative Analytical Procedures", *J. Chem. Ed.*, 3, 177, 1926.

(7) Bowers, "Notebooks in Laboratory Instruction", J. Chem. Ed., 3, 419, 1926.

(8) Cronkhite, "A Handbook for College Teachers", Harvard University Press, Cambridge, 1951.

(9) Flexner, "Medical Education, MacMillan Company, New York, 1925.

(10) Fowlkes, "Higher Education for American Society", Chapter 15, University of Wisconsin Press, Madison, 1949.

(11) Dietrick and Berson, "Medical Schools in the United States at Mid-Century", McGraw-Hill Book Company, New York, 1953.

PURPOSES AND VALUES OF TESTING

ROBERT L. EBEL

Director of University Examinations Service

State University of Iowa

The first requisite to the improvement of examinations is a clear understanding of their purposes and values. Instructors as well as students sometimes find examinations unpleasant. They tend to rationalize their feelings by criticizing examinations or belittling their importance. Unfortunately there is much in the typical examination which deserves criticism. The English educator, Sir Richard Livingston, in his book *Education for a World Adrift* has included a chapter entitled "Twin Dragons in the Road". One of those dragons is the examination system of certain English universities. While the system Sir Richard criticizes does not prevail in this country, he would find much support here for his thesis that examinations tend to interfere with, rather than to assist, the process of education.

On the other hand there is no evidence that criticism of examinations in education has led to any general decrease in their use. Those who attempt to dispense with evaluation of student achievement, or to use methods other than examinations as the principle basis for that evaluation, seem to relearn rather quickly the lesson of educational experience. The evaluation of achievement is indispensable. There is no substitute for well-constructed examinations in the evaluation process. We do not wish to minimize the seriousness of examination weaknesses or of the errors often made in using examination results. But it is our firm conviction that the achievement examinations constructed by college professors do serve a useful purpose in education.

It is not only in the classroom that educational achievement tests are useful. Testing is big business. Government agencies, private industry, professional schools, and a variety of other organizations have sharply increased their demands for good measures of educational achievement. The expanding activities of such organizations as the Psychological Corporation, Science Research Associates, the Educational Testing Service, the Educational Records Bureau, and The College Entrance Examination Board, reflect the broad demand for valid measures of educational achievement.

Let it be pointed out again that the educational value of an examination is dependent almost entirely upon its quality. Good examinations have beneficial effects. Bad examinations are harmful. Examinations which divert pupil attention from the main educational goals, which hold the student responsible for remembering how he was taught rather than for showing what he has learned to do are all too common. It is possible to over-emphasize the use of examinations, and such over-emphasis sometimes occurs. But there has seldom been over-emphasis on the use of *good* examinations.

It is true, as Sir Richard Livingston points out, that examinations do exert pressure on students. But this pressure is essential, in most cases, for optimum achievement. It is also true, as many "Progressive" educators point out, that examinations focus the student's attention on achieving the goals set up by the instructor rather than goals which the student has set for himself. Self-directed education is important. All of us can and should engage in it. But at the professional school level, the instructor must do considerable directing. An instructor who is not better qualified to set up goals for a student's professional education than the student is himself has little justification for occupying a professional position.

There are several types of examinations used in education, and they serve different functions. We will consider briefly three major types: aptitude tests, achievement tests, and personality tests.

Aptitude tests are essentially tests of achievement in skills basic to further achievement. In some quarters it is popular to regard aptitude tests as measures of native endowment. From our point of view this is not a useful concept. By the time a child is ready for pre-school or kindergarten, and certainly by the time he enters college, his native endowments are so overlayed and modified by his educational experiences that it is practically impossible to discern them.

The principle functions of educational aptitude tests is to aid in the selection and placement of stuents, and to facilitate adjustment of instruction to individual and group abilities. For this purpose, tests measuring those abilities which are used directly in the necessary instruction are best. Students of pharmacy, in common with most other college students, have to read and interpret the meaning of what they read, have to write and express themselves clearly in writing, and have to use arithmetic or other forms of mathematics to solve quantitative problems. It follows that a series of tests measuring, at the college level, reading skills, vocabulary knowledge, writing skills, and mathematical abilities provide the most appropriate measures of educational aptitude.

Let us turn next to a consideration of personality tests. This area is at once the most challenging and the most frustrating in the whole field of educational measurement. We see on every hand students who are outstanding successes in life primarily because of their personality characteristics, and others who, in spite of outstanding educational abilities, fail to achieve as they should because of personality deficiencies. But

personality is so complex and dynamic that it has largely resisted our efforts to measure it or to improve it through instruction. Our successes in personality improvement are intermittent, and largely accidental. Our attempts to measure personality development usually yield unstable scores of uncertain meaning. The modesty of our success in the field of personality measurement is no reflection upon the ability or energy of those who have worked in the area. It is rather an indication of the magnitude and the complexity of the problem which they are trying to handle.

The principal focus of our attention in this discussion is on the third type of test, the achievement test. While some educational achievement tests are available through commercial distributors or through wide scale testing programs, the bulk of them are produced by classroom teachers. The immediate use to which these test results are put is ordinarily to provide a firmer basis for assigning marks.

Some educators have attempted to make an important idea out of the notion that there is no *intrinsic* importance in the grade itself. It seems to me they only succeed in correcting an error of their own making. No one except those who wish to attack the idea has ever suggested that a grade was *intrinsically* important. But the effect of this clamor on the uncritical has been to weaken their belief in the significance of grades as *symbols* of achievement. We need not apologize for giving marks. Achievement is important, and it is important to report that achievement as accurately as possible. It is specious reasoning indeed to argue that since grades are only symbols of something important they are not worthy of serious attention.

But achievement tests have other functions than the assignment of marks. They motivate and direct study and teaching. They aid instructors to define their educational objectives in operational terms. They facilitate research on educational problems. Let us give some further attention to each of these areas of usefulness.

Anyone who has been seriously concerned with his own education, or with the education of others, recognizes the fact that examinations prove powerful incentives to study, and influence the direction of pupil emphasis in study. If a student knows that an examination is likely to require recall of factual details he will aim to stuff his mind with those details. If he knows that the examination is going to require him to deal with practical problems he will seek to learn the rules of procedure for dealing with such problems and to practice their solution. In order for examinations they present problems and occasions and teaching they should be made out before the course begins and their general nature should be described to the students.

Formal written examinations are indeed phenomena peculiar to the classroom, but if they are good examinations they present problems and occasions for decisions similar to those the student will face later in the application of his knowledge. Examinations provide practice in the tasks which will recur frequently in life.

Those who argue that we should protect students from the mental strain involved in preparing for and taking an examination seem to ignore the very obvious fact that most vocations require periodic preparation for crucial performances, and that the strain of decision making cannot be avoided as long as human beings are free to make their own decisions..

Because examinations take time away from lectures and class discussions they are sometimes regarded as barriers to maximum achievement. But the process of taking good examinations is in itself an effective learning exercise. There is abundant evidence in the literature of educational psychology that students who are examined periodically progress more rapidly than those who are not.

A frequently overlooked value of examinations is the incentive and opportunity they provide for instructors to clarify their teaching objectives. When instructors undertake to state their educational objectives they ordinarily do it in the most general and high sounding terms available. It is easy to get general assent to impressive but vaguely stated objectives. Unfortunately such objectives prove relatively ineffective in directing instruction. Instructors often do not realize that they are defining objectives concretely and operationally when they make a test. As a consequence they often make tests which operationally define objectives other than those they profess to be pursuing. Such unintentionally defined objectives may not direct the instructors teaching, but if known to the students are certain to direct their learning.

It is one of our major theses that a good test of educational achievement measures as directly as possible of the ultimate objectives of instruction in the course. It is our further thesis that there is no educational achievement which we can teach consciously and effectively which cannot also be measured with some degree of accuracy. A carefully prepared examination provides clear evidence of the competence of the man who prepared it, the accuracy of his information, the educational values he holds, and the sensitiveness of his perception of student capabilities and misconceptions.

These are some of the most important purposes and values of testing. We have not discussed the contributions of examinations to educational research, or to the maintenance of standards of achievement. But perhaps what has been said is sufficient to support the general thesis that we need to be concerned about the nature and quality of examinations we use, and need to spend time, individually and collectively, in improving our skills in the selection or construction and in the use of these essential instruments.

ESSAY AND SHORT ANSWER QUESTIONS

ROBERT L. EBEL

Director of University Examinations Service

State University of Iowa

One of the most persistent and troublesome issues in the field of educational achievement testing concerns the relative merits of essay and objective tests. It is easy, but not very helpful, to dispose of this issue by asserting that each has unique qualities and deserves its own place in the measurement of achievement. Nor is the problem solved by pointing out that there are far greater differences between the usefulness of good and poor tests in either form than there are between typical specimens of the two forms. Too many college instructors have an emotional attachment to one form or the other which lead them to overlook its limitations, and to dismiss without serious consideration the possible advantages of the other form. There is little we can undertake to do here about attitudes toward essay or objective tests. But we can present some information concerning their possibilities and limitations. Let us consider first the characteristics of essay test questions.

An essay test item is a question or statement of directions which requires the examinee to compose a response of one or more sentences in his own words. Not all essay questions are test items. Those whose primary function is to explore a student's thinking and to reveal his opinions or attitudes, rather than to measure his achievement, are not properly regarded as test questions and are excluded from this discussion. While we have already contrasted essay test questions with objective test questions it needs to be pointed out that in either form only that component of the evaluation which is objectively verifiable, that is, which can be agreed on by independent observers represents *useful* measurement. Objectivity is a necessary characteristic of measurements. Only to the degree that essay test questions permit objective measurement are they useful in the measurement of educational achievement.

Essay tests are probably more widely used than objective tests in classroom achievement testing today. This is primarily due to the greater convenience in the use of essay tests with relatively small groups. The time required to make out a good objective examination is considerable. Unless it is to be administered to a large group of students, the saving in time when it is graded is not sufficient to compensate for the added time used in constructing it. Conversely, the use of essay questions in wide-scale testing programs such as the Regents Examinations, or the College Entrance Examinations has declined sharply. The time and expense of accurately evaluating large numbers of essay answers is great enough to encourage the development of objective tests to do the same job.

Many test users feel that essay tests are better adapted than objective tests to the measurement of high level abilities, complex achievements, synthetic or creative abilities, and personality factors or attitudes. These claims that essay questions measure the important larger goals of education, which are not easily measured objectively is open to two criticisms. First, it is generally based on a lack of understanding of the possibilities of objective examinations. The notion that only discreet isolated factual information can be measured with objective tests is widely held. Second, these claims are generally accepted without proof, evidence, or convincing logic. Many of the traits supposedly measured by essay tests are identified by name only, not by practically useful objective description. They are often unstable, poorly defined, and hence inherently difficult to measure.

Some test users feel that essay questions present a truer picture of the student's abilities since they are "more difficult", more searching and more revealing. It should be pointed out, however, that objective test items can be made as difficult as desired, and in many cases turn out to be more difficult than they ought to be for optimum measurement.

Certain other advantages of essay test items are frequently mentioned. They do not suggest an answer, but require the examinee to produce his own. They do not permit successful response by guessing. They are relatively easy to prepare. They are well adapted to testing small groups. They have a desirable influence on study, directing student's attention away from isolated bits of information and toward the understanding and integration of ideas. They require the student to practice expressing himself in writing. The alleged decline in student writing ability is often blamed on the wide use of objective tests. Perhaps at this point, it is appropriate to point out that the practice afforded in writing essay tests is often practice in bad writing, hasty writing, unrevised writing. There is no substantial research evidence that, all other things being equal, students who have been repeatedly exposed to essay examinations tend to write better than those who have not.

The most clearly established weakness of the essay test is that it tends to yield scores of low reliability. While reliability is not the most essential characteristic of a test (validity is), the value of any test is sharply limited by lack of reliability in the scores it yields. Essay examinations tend to compare unfavorably with objective examinations in reliability of grading, reliability of sampling, and reliability of student performance. By reliability in grading we mean the extent to which two independent readers agree in evaluating the same essay test paper. By re-

liability in sampling we mean the extent to which scores vary in response to the selection of certain questions rather than other equally good questions for inclusion in the test. Essay tests ordinarily consist of ten to fifteen questions, whereas objective tests may include ten times as many. Sampling errors associated with small samples (small numbers of questions) are always greater than those associated with large samples.

By reliability in performance we mean the extent to which a student's achievement as indicated by the examination appears to vary on repeated administration of the same test. It is reasonable to believe that a student's alertness, interest, or luck in choosing an attractive answer or in expressing himself effectively may vary considerably from day to day. His score on any one day may either overstate or understate his achievement.

The essay question tends to be inefficient in its use of the pupil's examination time, and of the teacher's grading time. Essay examinations depend essentially on student writing. Students can read and think very much faster than they can express themselves in writing.

Let us turn our attention next to some of the possibilities and limitations, of objective type test items. In this discussion attention will be focused on multiple-choice type items. There are of course other useful types of objective test items such as true-false, matching, classification, and short answer. None of these have the general utility or effectiveness of the multiple-choice type items. The time at our disposal precludes detailed treatment of them.

One of the obvious limitations of objective type test items is that they do not require the examinee to think of an answer and to express it clearly in his own words. When these two abilities are paramount objectives of instruction, it is quite obvious that essay test questions have definite advantages over multiple-choice items for measuring the extent of achievement. But in many, if not most subjects of study, these abilities are not, and should not be, primary objectives of instruction. The ability to make right choices and correct decisions are often far more important.

All of us are occasionally embarrassed by our inability to think of a good answer on short notice, or to express and defend our ideas effectively. But, is it not true that our successes have been primarily due to the right choices we have made at crucial moments when the alternatives were clearly known? Is it not also true that our deepest disappointments are associated with wrong decisions which we or others made when the alternatives were clearly apparent? The seeming simplicity of picking a right answer out of several suggested answers may be an illusion. Many factors must often be brought into the pictures, and judged for their relevance, and interpreted for their implications. A great deal of high level reasoning must frequently be done before the simplest yes or no answer can be given confidently.

There is a curious notion abroad in some educational circles that the answer a student arrives at is less important than the means he used in arriving at it. (I hope my pharmacist does not attach more importance to his methods than he does to his results). This is almost equivalent to saying that one can use a proper method correctly and still arrive at an incorrect answer, or that an incorrect method can consistently give right answers. It is true that a good teacher will always wish to observe a student's method of work in order to determine where he is making errors, if any, and in order to correct them. But that instruction is not evaluation. It seems unnecessarily indirect to evaluate achievement mainly in terms of methods of work rather than mainly in terms of results obtained.

One of the most common misconceptions concerning the limitations of objective tests is that they are suitable only for discreet items of factual information. Unfortunately many objective tests are composed almost exclusively of items of this type. These items ordinarily have rather brief stems, and one or two word responses. It is not surprising that teachers who have been exposed to these poor samples of the application of objective techniques should believe that this limitation is inherent in the form itself.

One good way of illustrating what other kinds of achievement can be measured through multiple-choice test questions is to present some examples. The first exhibit is a list of representative types of multiple-choice items. Most of these are items taken from a contemporary affairs test. May I draw your attention specifically to the first group of items which are vocabulary items. In any new subject the mastery of appropriate vocabulary is one of the primary tasks of the student. The extent of his knowledge of correct meanings is a significant indication of his achievement.

Another type of item worthy of special attention is the one whose stem begins with the word "Why". The single characteristic which most clearly differentiates a scientific mind from a non-scientific mind is the scientific mind's preoccupation with the question "Why?" A generous proportion of the items in any test ought to deal with questions of causes, reasons, and purposes, and ought to be expressed in questions beginning with the word "Why".

Finally, your attention is directed specifically to questions of application such as those described under headings 9 and 10 on the list of examples. Knowledge of how to perform a required operation, or of what to do under specific conditions, provide excellent evidences of the degree of mastery which the student has achieved.

A second exhibit illustrating the potentialities of multiple-choice type items illustrates the conversion of an essay test question and answer into a series of objective test questions designed to measure the same important abilities. This illustration grew out of a series of conferences with a professor in the College of Dentistry. He had been long accustomed to using essay type questions to measure achievement. While anxious to employ objective questions wherever possible, he was held back by the feeling that some of the essential abilities measurable in the essay question could not be dealt with in objective questions. More specifically, he felt that it would be difficult to test a student's knowledge of the correct sequence of operations, or to avoid giving away the correct answers, in multiple-choice type exercises. We do not have any experimental evidence that the objective type ques-

tions here presented would do as good a job or a better job than his essay test questions had done. But we agreed that the objective test questions were covering essentially the same ground, and that they seemed capable of providing the desired discrimination between good and poor students. I would recommend this process of converting an essay test question into equivalent objective test items as an excellent way of demonstrating the possibilities of multiple-choice type test questions, and of correcting misconceptions concerning their limitations.

This discussion of essay versus multiple-choice type test questions would not be complete without at least a word concerning the essential qualities of good multiple-choice test items. These are essentially three.

1. The questions should deal with a significant aspect of achievement.
2. The correct answer should be clearly better than any of the other alternative responses offered.
3. Each of the other alternative responses should prove attractive to certain students of low achievement.

You may have gathered from this discussion a certain amount of bias on my part in favor of multiple-choice type items. This I must confess. It is not however a blind bias, nor one which ignores the usefulness of essay test questions for measuring special skills or for the measurement of achievement in small class groups. But my preference is based on the conviction that much wider and more effective use of objective type test items could be made in many college classrooms.

REPRESENTATIVE TYPES OF MULTIPLE CHOICE QUESTIONS

1. Ask what a term means.
   The term "fringe benefits" has been used frequently in recent years in connection with labor contracts. What does the term mean?
   (1) Incentive payments for above-average output
   (2) Rights of employees to draw overtime pay at higher rates
   (3) Rights of employers to share in the profits from inventions of their employees
   * (4) Such considerations as paid vacations, retirement plans, and health insurance
2. Ask what was (or is) true in a specific instance.
   What action did President Syngman Rhee take during the summer of 1953 to force the United Nations Command to give more consideration to his wishes?
   * (1) He freed prisoners of war guarded by South Korean troops.
   (2) He launched his own offensive on the North Koreans.
   (3) He ordered his troops to seize shipments of United Nations supplies.
   (4) He offered to sign a separate truce with the Chinese.
3. Ask what was (or is) true in general.
   What opposition, if any, was given to local plans for fluoridation of public water supplies to combat tooth decay?
   (1) There was no opposition to the plans.
   (2) Many water companies objected on the grounds that the flourides would corrode their pipes.
   (3) Most dentists objected on the grounds that the treatment would be ineffective.
   * (4) Some people objected on the grounds that fluorides are harmful to health.
4. Ask how two things compare, differ or are similar.
   How did the estimated amount of petroleum discovered in new fields in 1953 compare with the amount extracted from producing fields the same year?
   (1) The estimated amount discovered was practically zero.
   (2) The estimated amount discovered was about half of the amount extracted.
   * (3) The estimated amount discovered just about equaled the amount extracted.
   (4) The estimated amount discovered was greater than the amount extracted.
   What do Henri Matisse and Pablo Picasso have in common?
   (1) Both are European orchestra leaders.
   (2) Both are Metropolitan opera tenors.
   (3) Both are French movie directors.
   * (4) Both are contemporary painters.
   How did intercollegiate football in 1953 differ most from that in 1952?
   (1) The penalties for infractions of rules were much more severe in 1953.
   * (2) The use of separate offensive and defensive teams was discontinued in 1953.
   (3) The use of the T formation was abandoned in 1953.
   (4) More use was made of the forward pass in 1953.
5. Ask what the chief problem or basic issue is.
   What basic issue regarding parochial schools has been raised most frequently in recent years?
   * (1) Are such schools and their pupils entitled to aid from public funds?
   (2) Is it permissible to use school time for religious instruction in parochial schools?
   (3) Should such schools be permitted to operate where public schools are available?
   (4) Should such schools be required to accept any pupil who wishes to attend?
6. Ask why something is true.
   Why has the Fifth Amendment become prominent in investigations of alleged Communists?
   (1) It gives Congress the right to investigate loyalty and subversion.
   (2) It guarantees freedom of speech, freedom of the press, and freedom of religion.
   (3) It states that any accused person has a right to be heard in his own defense.
   * (4) It states that a person cannot be compelled to be a witness against himself.
7. Ask what is likely to happen under certain conditions.
   What would happen if the terminals of an ordinary household light bulb were connected to the terminals of an automobile storage battery?
   (1) The bulb would light to its natural brilliance.
   * (2) The bulb would not glow though some current would flow through it.
   (3) The bulb would explode.

(4) The battery would go dead.

8. Ask what inference may be drawn from certain evidence.
   What was illustrated by events in 1953 involving Anna Pauker of Romania, Klement Gottwald of Czechoslovakia, and Matyas Rakosi of Hungary?
   (1) There is an increasing tendency for satellite leaders to follow Tito's example in acting independently of Moscow.
   (2) The fate of anti-Communists in satellite countries is sudden death.
   (3) The position of Communist leaders in satellite countries is secure.
   * (4) The position of Communist leaders in satellite countries is precarious.

9. Ask how to do something.
   To care for formula bottles one should
   (1) rinse, wash with brush, and keep in refrigerator until ready to make formula
   (2) rinse immediately after use, fill with cold water, and before formula is to be made for the day, washs with hot soapy water and brush and rinse
   * (3) wash with hot soapy water immediately after use, rinse, cover, and let stand until ready to make formula
   (4) rinse well after use and wash with family dishes the first time these are done after bottle was emptied.

10. Ask what to do under certain conditions.
    Stuttering in a child soon after onset should be treated by:
    * (1) Counseling parents and advising them and disregard the overt symptom
    (2) Advising parents to correct child whenever he stutters
    (3) Removal of tonsils and adenoids
    (4) Cutting the frenum of the tongue

ALTERNATIVE ESSAY AND OBJECTIVE APPROACHES TO MEASUREMENT OF THE SAME ACHIEVEMENT

I Essay Approach

Q. Sometimes a bridge will not go to place properly when being tried in the mouth after being soldered. If the operator should consider it advisable or necessary to unsolder, reassemble and resolder the bridge, describe how this should be done.

A. The operator should first determine which joint or joints are to be unsoldered. The parts of the bridge should never be separated with a saw or disc as this leaves a wide space to be filled in with solder. Instead, the bridge should be held in a blow torch flame in such a way that the flame is directed on the joint to be unsoldered. Only enough heat must be used to melt the solder and care must be used not to melt or distort an abutment piece. When the parts of the bridge have been separated, they should be pickled in acid to clean them of oxide. It will be necessary to use a disc or stone to smooth and reduce the amount of solder at the joints before the bridge will go to place in the mouth. This must be done till all parts of the bridge can be reassembled in the mouth. Place some Parr's flux wax on all contact points of the abutment pieces and pontics, (this is done with the pieces outside the mouth) then place all pieces back in the mouth. The Parr's flux wax will hold the parts in place and the wax is soft enough so the pontics can be moved around to a certain extent to get them in the right position. When positioned properly, the joints should be reinforced with sticky wax which is hard and brittle and will hold the parts firmly together. Then to further reinforce and strengthen the bridge so the parts will not be disarranged while taking the impression, a short piece of wire about 16 gauge should be bent and placed along the buccal or labial surface of the bridge and the approximating teeth and held firmly in place with sticky wax. All this waxing must be done with the field perfectly dry because any moisture will positively prevent the wax from holding. Then a small, shallow impression tray is selected, filled with a fast-setting impression plaster and a shallow occlusal impression (if for a posterior bridge) or lingual and incisal impression (if for an anterior bridge) is secured. The impression is removed from the mouth, the bridge also removed and reassembled in the impression, the joints filled with Parr's flux wax, the plaster impression given a coat of separating medium, and the exposed parts of the bridge covered with soldering investment. When the investment is set, the plaster impression is cut away and more soldering investment applied in the proper manner to provide for correct soldering. The case is now ready to be heated and soldered in the regular way.

II Objective Approach

The following eight items deal with the problem of separating, reassembling and resoldering a bridge which will not go into place properly after being just soldered.

1. Which joint or joints should be separated?
   (1) The joint between pontics and smallest abutment piece
   (2) Any single joint (The faulty joint must be located by trial and error)
   (3) All that were originally soldered
   * (4) Only the one or ones which appear responsible for the failure to fit

Note: Only one of the following two items should be used.

2. Should the joints be separated using a saw or disc rather than heat?
   (1) No, because the saw might damage the original castings
   * (2) No, because the saw will leave too large a gap to be filled with solder
   (3) Yes, because the use of heat might damage the original castings
   for resoldering
   (4) Yes, because the saw leaves a clean joint ready

3. Should the flame be concentrated on the joint to be unsoldered? Why?
   (1) No, because the bridge may crack if heated unevenly

(2) No, because the abutments must be thoroughly heated before the solder will melt
* (3) Yes, to avoid damage to the other pieces
(4) Yes, to avoid delay in separation

4. After the bridge has been separated what, if anything, needs to be done before reassembling it in the patient's mouth?
* (1) The pieces should be cleaned in acid, and the joints smoothed with a stone
(2) The pieces should be cleaned in acid, but the joints should not be smoothed
(3) The joints should be smoothed, but the pieces need not be cleaned in acid
(4) Reassembling should begin as soon as the bridge has been separated

5. What is used initially to hold the pieces together on reassembly in the patient's mouth?
(1) Sticky wax
* (2) Parr's flux wax
(3) Impression plaster
(4) Soldering investment

6. Which of the following materials – flux wax, sticky wax, metal wire, and soldering investment – are used to hold the pieces of the reassembled bridge in place prior to taking the impression?
(1) All of them
(2) All but metal wire
* (3) All but soldering investment
(4) Only flux wax and sticky wax

7. What precaution is necessary in using sticky wax?
(1) It must not be allowed to touch gum tissues
(2) It must be applied in separate thin layers to avoid cracking
(3) The surface to which it is applied must be moist
* (4) The surface to which it is applied must be dry

8. What function does the plaster impression have in the process of resoldering the bridge?
* (1) It holds the parts in place while soldering investment is applied
(2) It holds the parts in place while they are being soldered
(3) It permits the resoldered bridge to be checked before insertion in the patients mouth
(4) It has no function in resoldering the bridge

SCORING AND GRADING EXAMINATIONS

ROBERT L. EBEL
Director of University Examinations Service
State University of Iowa

The discussion of this topic will be divided into three parts. The first will be concerned with suggestions for grading answers to essay test questions. The second will consider some methods and devices for scoring objective examinations. The third will be concerned briefly with methods of grade assignment.

There are two general methods of evaluating essay test answers. One is analytical scoring, in which the rater looks for certain specific characteristics of the response and arrives at a total score on the basis of the number of these characteristics which are present. The second is quality scaling, in which the answer is judged as a whole. It is marked superior, good, average, poor, or inferior, on the basis of the over-all impression which it leaves with the rater. Neither of these methods has any universal superiority over the other. In certain situations analytical scoring is relatively easy to apply. In others it is quite difficult. Where applicable, analytical scoring probably results in more reliable evaluation than quality scaling.

One of the hazards in the evaluation of essay test answers is the possibility of a general change in the rater's level of severity or leniency. Most raters are conscious that such changes can occur. One reads a particularly poor answer and decides that the group as a whole has failed to achieve an adequate level of mastery. He consequently begins to grade with greater severity. Again, a succession of low scores may lead the rater to assume that his standards are too high, and that he ought to ease up somewhat. These changes in general level of severity in grading cannot be prevented completely, but the scorer who is aware of them can minimize their influence. One very effective technique is to grade one question at a time through all papers before going on to the next question. When this is done, the effect of a change in the level of severity does not affect a few students as severely as when all questions on a single paper are graded together. An added advantage of marking one question at a time through the entire group is that it facilitates establishment of relative standards for grading the answers, and thus insures greater uniformity in grading from paper to paper.

Another hazard in the grading of essay test questions is the possible influence of irrelevant factors on the test score. Neatness and legibility of handwriting, correctness in grammar, punctuation and spelling, or general effectiveness in presentation are frequently important factors in the score which a student receives on an essay examination. Many graders would argue that this is right and proper, and that students who have failed to develop these qualities deserve to be penalized for their failure. But if this philosophy is adopted the grades assigned do not reflect achievement in the particular instruction which the test is intended to cover. Any instructor who considers spelling, handwriting, etc., important enough to affect the grading of an examination should also consider them important enough to take time to teach in the course of his regular work. It is a good general rule to limit evaluation to those factors which were consciously taught during the course.

Another irrelevancy which may affect the score on an essay test is the reputation of the student whose paper is being graded. Most instructors form some opinion of the ability of a student during the early weeks of a course. It is difficult for them to avoid letting this impression affect the score they assign to a particular paper. One way of minimizing this "halo effect", is, of course, to conceal the name of the students while the rating is being done.

Experiments on the agreement between separate scorers reading the same set of papers, or even between a first and second reading of the set of papers by the same scorer, have shown widely varying results. In some cases the scorers or scorings show high agreement. In other cases they show wide diversity. The general conclusion is that essay test papers *can* be reliably read if suitable precautions are taken to objectify the scoring process, and if the scorer takes sufficient pains with his work.

The development of objective tests, and the demonstrated efficiency of separate answer sheets have led to a variety of devices to simplify and speed up the scoring of examinations. Even where answers are marked directly in the test booklets, objective tests could be scored faster than essay tests. The use of separate answer sheets made it possible to apply a stencil key to the answer sheet. Through this key the number of correct answers could be counted very rapidly. From this development it was a short but important step to the development of mechanical scoring devices such as the IBM Electrical Scoring machine. Most of you, I presume, are familiar with this device. Institutions which provide for IBM test scoring service have saved the users of objective examinations thousands of hours of time in processing their examinations. An added feature of the IBM test scoring machine is the graphic item counter, a device which facilitates analysis of the results of an examination, and this makes possible subsequent improvement in the quality of the individual questions and of the test as a whole.

For many years the IBM test scoring machine has been the only generally available instrument for the rapid electrical scoring of answer sheets. This year, two new developments are on the horizon. One is a somewhat simplified and less expensive desk type scoring machine developed by Engineers Northwest in Minneapolis, Minnesota. This machine, is to be available for limited use this fall. Its designer claims that it is much simpler than the IBM machine, but that it will perform effectively the essential operations in scoring objective examinations.

The other important development in the field of electrical test scoring has been going on at the State University of Iowa. Professor E. F. Lindquist and his associates have been engaged for several years in developing the Iowa Electronic Test Processing Equipment. This equipment is designed primarily to service wide-scale testing programs, involving relatively large numbers of answer sheets and extensive test batteries. It is expected to be available for use in 1955.

The equipment is almost fantastically versatile. There is scarcely any operation which one can think of doing with tests or test scores, or test items that the machine will not be capable of performing. It will score answer sheets, convert raw scores to scale scores, compute and convert sums of weighted scores, list reports of scores in triplicate, and report mean scores on individual tests or combinations. It will compute for any or all groups of answer sheets the variance of score distributions, the intercorrelation among the tests scored, or the odd-even reliability coefficients. Many types of special scoring such as weighted item or weighted response scoring, the scoring of items with multiple correct responses, or the simultaneous scoring of the same test with several different keys will be available. Individual report cards can be printed for each examinee in addition to the list report. It is anticipated later that the machine will produce frequency distributions of scores on the various tests and frequency counts of the number of correct responses to individual items.

The development of this equipment has cost several hundred thousand dollars. Its functions and capabilities may not be of immediate interest to many in this group, but it serves to indicate the extent to which efficient modern recording and computing techniques have been applied to the problem of educational measurement.

Since the eighteenth century, and possibly before that, when mechanical devices began to take over functions which had formerly been solely human functions, there have been those who have viewed with alarm the mechanization of human life. Today there are many, even among college professors, who are quick to follow the easy but quite superficial argument that the mechanization of test scoring represents one step in the mechanization of learning. Let it be pointed out that this new machine, complex and versatile as it is, does not yet write test items. Nor does it make the sort of value judgments which differentiate good examinations from poor examinations. So far as I can see, there is no reason to either hope or fear that such a machine will ever be developed. And I would call your attention to this paradox. Test scoring machines and other mechanical devices which facilitate accurate and extensive testing result in more rather than less treatment of students as individuals.

The more accurate knowledge we have, the greater our opportunity to deal with students as individuals, to recognize their special talents, to help them overcome particular deficiencies. Standardized testing, and mechanical test scoring, when properly used, do not tend toward standardization of the educational product or mechanization of learning.

Let us turn now to some problems associated with the assignment of grades or marks. Mention was made earlier that one of the primary functions of examinations was to assist in this process.

Educational institutions have fairly well standardized on a system of five letter grades to indicate levels of achievement. However, there still exist wide variations in the points of view of instructors concerning how this grading system ought to be applied. The general thesis from which this discussion begins is that the grading practices of an instructor, a department, or a college are matters of general concern to other instructors, other departments, or other colleges. This is so because the meaningfulness of grades depends upon uniformity in the application of a recognized grading system. Any instructor who gives only A's or B's to his students tends in the long run to change the meaning of such grades. In effect he is inflating the academic currency.

In many institutions it has become common practice to publish reports on distributions of grades issued by various instructors, departments, or colleges. These studies reveal two factors quite clearly. First, there is wide diversity between individuals and departments in the standards of grading employed. Second, there is a general tendency to give more high grades and fewer low grades than the system calls for. Sometimes instructors justify the issuance of many high grades on the ground that they are dealing with select students. If they have evidence of this fact, based on entrance test scores or prior grade point averages, their practices may be justified. In many cases, however, this "selected student" rationalization will not stand up under investigation.

College instructors can be expected to divide sharply on the issue of absolute versus relative grading. There is a considerable attractiveness to "absolute" standards of grade achievement. One may argue quite persuasively that whether a given individual is a good or a poor student in pharmacy should not depend upon how much his fellow students have learned, but rather upon how much pharmaceutical knowledge *he* has acquired. In practice, however, even those who profess to operate on the basis of absolute grading standards are largely influenced by relative standards. There is nothing inherent in the subject matter of pharmacy or any other subject, which defines a minimum level of competence. In all areas of education we base our notions of what *should* be accepted on our experience with what students *do* achieve. In education more is always better than less, and there exists no critical point below which the knowledge possessed is useless, and only above which it is effective. Evalutions of educational achievement are inescapably relative. One who "grades on the curve" is simply recognizing the realities of the achievement

measurement situation.

Another troublesome issue in the problem of grade assignment centers on the functions which these grades ought to serve. Should they reflect the level of achievement attained without regard to ability, or should they be adjusted to a student's ability and thus reflect the effectiveness of his efforts. It has been our position that the only legitimate purpose of an educational grading or marking system is to provide clear indications of a student's *actual* level of achievement relative to that of other students. Whether the student in reaching this achievement used his talents effectively or ineffectively, whether he made the achievement easily or with great effort, are matters which properly concern the student and his instructors, but which should not contaminate the measure of his actual achievement.

Grades have often been used to serve less laudable purposes than the measurement of achievement or the reward of effort, such as attracting students, punishing offenses, and so forth. These other uses tend to vary widely from instructor to instructor. They are commonly ignored in grade interpretation, and tend to destroy the meaningfulness of grades as indications of achievement.

At this point it may be useful to call attention to a theory of grade assignment which is superficially attractive, but practically difficult to implement. This is a theory that grades assigned should reflect the amount of educational growth or development achieved during a course. Under this theory, a student who enters a course with relatively weak background and makes relatively great gains in his knowledge in the area deserves a higher grade than one who enters the course with a relatively good background and makes relatively little advance, even though the knowledge of the first student at the end of the course is still below that of the second student. Such a system of grading seems intrinsically fair and well calculated to stimulate maximum effort from students at all levels of ability. Unfortunately it is subject to two objections. The first is the point already mentioned that such grades are difficult to interpret. Effort and achievement are so inextricably confused that no one can tell for sure whether a given student really knows a great deal about chemistry, or whether he made noble efforts in acquiring what little knowledge he does possess.

The second objection is that grades based on growth measures are unreliable almost to the point of uselessness. Such grades must be based on the difference between initial and final measures of achievement. Unless both these measures are highly reliable, and unless the correlation between them is relatively low, the grades based on differences will reflect largely errors of measurement rather than true gains in achievement.

In concluding this discussion on grade assignment, two suggestions may be offered. The first is that a statement of principles for grade assignment should be formulated, debated, and approved by each faculty as a guide to all instructors in their grade assignment. The second is that regular publication of distributions of grades in individual courses and departments is the most effective way of calling attention to the need for uniform standards and of encouraging uniform observance of these standards.

THURSDAY DISCUSSION

Q: What importance should be attached to the final examination as opposed to other examinations?

A: I believe that the evaluation process should be spread out. I believe that unit tests or quizzes should be given in addition to a final examination and not let evearything hinge on one exam. Too often a student's evaluation is inadequate if much emphasis is placed on one examination. On the other hand I like an exam that covers the entire work of the course, but I do not believe that this should be used as the sole basis for grading, but it avoids giving the student the impression that what he learns this month can be forgotten after each test.

Q: What about the frequency in giving tests, say in a 3 hour course.

A: There is no scientific evidence which sets an optimum frequency of examinations, and I should imagine this should vary from course to course. In an introductory course more frequent examinations will probably be found more useful. At the college and graduate level up to 10% of the students' class time can profitably be used in examination, providing you have many good examinations. Too many instructors are not willing to spend the necessary time that is required in writing a truly good examination.

Q: Of what value is knowledge of the probable score error in the examination?

A: Its main value is in telling the instructor what the median score error is. It should be realized by the instructor that there is going to be some error in whatever method of grading he uses and that it is of extreme importance that he does the best that he can in writing the exam.

Q: What about the availability of interest tests, or tests to measure a student's drive, or persistence?

A: There are tests available and they consist of a series of very difficult exercises, some of them insoluble, in which you ask a student to make words out of a series of letters which acutally can not be arranged into a word. Then you measure the time that he works on it. This type of test is still in the experimental stage and there are limitations to its findings. It is very difficult to measure the type of motivation in a single test that would be necessary, for a student in a semester course. I couldn't recommend one test that I could bank on as a suitable measure to test this persistence. This experimental test has shown in a way that it aided in predicting the student's success in college, but that it was only a small aid.

Q: What is the importance of the instructors knowing something of the statistical terms used in these tests?

A: I think that it is quite important. But we find that most or at least many do not thoroughly understand what is meant by such terms as standard deviation. I think that before a sutdent graduates and goes out to teach, he should become acquainted with the types of tests used in measuring a

student, and also acquaint himself with some of the terms.

Q: What do you do with an examination, once it has been given?

A: I believe that the examination should be given before the final day of school, so that time can be taken to go over some of the results. I am in favor of discussing the examination with the students, with caution, but don't give the student the idea that if he just knew the answers to those questions that he would be an expert in the field. At best any test is just a sample of all the questions you could ask, and you don't make a student amaster by just teaching him the answers to a list of questions. On the other hand they are good teaching aids.

Q: What about the merits of multiple choice questions where you have one correct answer versus multiple choice where you have more than one correct answer?

A: The second type is limited to cases where the student can make absolute judgment with regard t oeach staement as being correct or incorrect. The other type often called the best answer type lends itself ot some courses, but many times it is unreasonable. So long as you are dealing with situations where the answers are clear and definite, where the student has seen the definite answer in a laboratory notebook or what have you. then I say it is fair to use the multiple choice item, but in most cases I would not use it.

Q: What about the situational type test item?

A: These are extremely valuable questions. Some difficulty is sometimes encountered in being able to phrase the situation, to get the essentials of the situation in a cncise enough form.

Q: What about the percentage of failures, as called for by a system?

A: If you define failure as need to repeat the course, or getting no credit for the course, or being dismissed from college, the failing mark should never be assigned automatically in terms of any statistical grading system, but should always be decided upon or decided against in terms of what is going to be best for the student in the long run, and what is best for the institution. Grades should play a large share in that decision, but no automatic decision shauld be made. Students should never be failed solely because of use of a grading system which presupposes a certain percentage of failures.

Q: What about expanding a grading system in using of pluses and minuses?

A: This practice is largely frowned on because it clutters up the grade recording mechanism, but our modern methods of measurement do permit us to discern more than 5 levels of achievement, and we lose considerable information by limiting it to 5.

Q: What about the subjective influence in the construction of so called objective questions, and how do they compare with essay type?

A: In the objective type question the students task is made clearly evident and the basis for evaluating it is made much more obvious than in the evaluation of the essay type question. But I do believe that subjective judgment does go into the construction of this type.

Q: What do the inflated score in objective type tests do to chance correct response, in so called guessing problems?

A: If the student is allowed sufficient time to attempt all items, and if the items are reasonable for the students concern, they are going to read each question and each alternative given, and while they may not have much basis for deciding on the answer, they will use every bit of information they have. When they have read the question, and do not mark just blindly, then the laws of chance do not apply, and in general the student who has the greater knowledge will get more of the questions right, if they have been properly constructed.

Q: What checks do you use to prevent ambiguous statements in a test and if you do discover it, what do you do about it?

A: The best technique is to take the test to one of your colleagues and have him mark the answers. This method is as good as any. In the case where ambiguity is found after the test, it can be ruled out, if it is machine scored, and if it is not discovered until after the test has bee nscored, if it is important enough it can be rescored.

Q: How much time should be allowed for the typical objective type examination?

A: The amount of time varies considerably with the character of the question. As a general rule the best multiple choice test will average about one choice per minute. The true-false type will allow about two per minute.

Q: What is your idea concerning the all or none type test?

A: Less clear cut separation between the good student and the poor student can be made by tests of this type, as opposed to tests wher you count the individual items in your scoring.

Q: When you have an examination consisting of items, some of which are very time consuming and others which can be answered very quickly, what should the mechanics be in giving the examination. and in relative weighing for scoring?

A: When operating at the professional level, as we do in pharmacy, the student should be given adequate time to attempt all of the items, and not be under any pressure for speed. In any professional field accuracy is far more important than speed and our tests ought to reflect that. In general for measurements of educational achievement there are few situations where giving more credit for one objective question than another is justified.

Q: Are there any advantages in combining essay and objective questions in the same test?

A: Generally not. Only in those rare instances where something cannot be measured in any other way, should they be combined.

THE EVALUATION OF THE TEACHER

R. A. DENO

Professor of Pharmacognosy

University of Michigan

An outstanding feature of our week-long and profitable session has been the wholesome and productive differences of opinion on many of the topics presented and discussed. On no topic in education is there room for greater difference of opinion than on Evaluation of the Teacher. One reason for this is that no one has ever devised a good objective approach to the problem – probably no satisfactory objective approach exists.

So the best I can hope to do here is to borrow from the opinions expressed by others, summarize a few of the pertinent studies that have been published, and express some of my own views. I do not expect concurrence among the many experienced teachers here. I do hope, however, we will all give thought to the problem and to solutions that have been suggested as being worthwhile.

During the past twenty-five or thirty years much has been written on evaluation of college teachers in general, and on closely related topics. A number of studies and opinions have paid special attention to teachers in science. But no study, including the Pharmaceutical Survey, and few opinions have dealt specifically with qualities desirable in pharmacy teachers or with their evaluation. This lack is not of great moment, because in general, the superior pharmacy teacher has qualities found in the superior science teacher. And most of the desirable qualities of science teachers are common to good college teachers in general.

I suppose evaluation of college teachers, at least informally, has been attempted ever since colleges have existed, and probably from the two points of view personified here by the teachers and by the deans. There is much overlapping of characteristics prized in teachers by the teachers themselves on the one hand, and prized by administrative officers on the other. Differences of opinion between the two are likely to be in emphasis rather than absolute.

I feel sure every teacher here honestly wishes to be as effective as he possibly can. I am not so sure every one of us is willing to pay the price required. Someone has said that no teacher really believes himself to be a poor one. Each of us is likely to excuse his shortcomings and magnify his strong points. And true also is the fact that none of us is able fully to diagnose and remedy every one of his personal weaknesses. Each of us, therefore, needs whatever help he can get from others.

And deans generally are eager to build strong teaching staffs. They want initially to hire good teachers, eventually to make the good teachers permanent members of the college family, and rapidly to promote them to responsible well-paying positions, I hope. So administrative officers need to know how to evaluate their teachers. The economic significance of this evaluation to the teachers involved is quite obvious.

CHARACTERISTICS OF THE SUPERIOR COLLEGE TEACHER

In one of his books, Dr. Blauch has quoted an early French writer on education, Jacotot, as saying "To teach is to cause to learn." From this simple and direct concept it would appear that the best teacher is the one who provides ideal surroundings and does the most to stimulate learning on the part of his students.

More detailed analyses of the various characteristics needed by a teacher in order "to cause to learn" have been suggested by many college teachers and administrators. Dr. Blauch has discussed these qualities briefly in "Teaching in Colleges and Universities" (Appendix I, 2). A lengthy chapter on rating in "The Background for College Teaching" (3) by Luella Cole contains lists of characteristics of good and of poor teachers, including the well-known Purdue Rating Scale developed a quarter century ago by H. H. Remmers. From the administrator's point of view, Henry M. Wriston, President of Brown University, discusses desirable traits in "The Preparation and In-Service Training of College Teachers" (4).

One of the best summaries of more recent origin is contained in "The Student Looks at his Teacher" (10), by John W. Riley and associates of Rutgers University, Department of Sociology. I strongly recommend this inexpensive book to any teacher eager for help in improving his teaching. Appended to this paper (Appendix II) are summaries taken from Riley (A), from Cole (B), and from Wriston (C).

To compile their list of characteristics, the Rutgers sociologists studied the literature of teacher evaluation, interviewed students, and solicited opinions of experienced teachers. From some fifty traits, ten characteristics were deemed outstanding and were selected for use in a study of teacher evaluation by students at Brooklyn College. It seems to me these ten characteristics include a majority of the significant qualities emphasized by most other authorities.

The characteristics selected by the Rutgers group, not necessarily in order of importance, are:

1. Organization of subject matter
2. Speaking ability
3. Ability to explain
4. Encouragement to thinking
5. Attitude toward students
6. Knowledge of subject
7. Attitude toward subject
8. Fairness in examinations
9. Tolerance to disagreement
10. Instructor as a human being

For each characteristic, four levels of performance are provided. Under "Organization of subject matter," for example, the four levels are:

a. Systematic and thoroughly organized
b. Adequate, could be better
c. Inadequate organization, detracts from course
d. Confused and unsystematic

Summary A in Appendix II includes the levels of performance suggested for each of the ten characteristics.

Taking the Riley list as a starting point, and with one or two additions, let us discuss briefly the evaluation of the pharmacy-college teacher: by himself, by his peers, by his students, and by his administrative superiors.

Self-Evaluation

A consummate teacher of biblical times, St. Paul, in his letter to the Galatians has said:

> For if a man think himself to be something, when he is nothing, he deceiveth himself. But let every man prove his own work, and then shall he have rejoicing in himself alone, and not in another.

I am sure St. Paul is using prove in the sense of test: let every man test his own work!

If we need a text for this part of our sermon, St. Paul's Letter, which has been called "a charter of religious freedom," provides an ideal one.

Writing in this Socratic vein in a recent number of the American Association of University Professors' Bulletin, Dean Willard Wilson of the University of Hawaii, in an article entitled "Physician, Heal Thyself," has provided a set of "Axioms for a Teacher." I would like to quote one of these: "Objective and deliberate development of the style best suited to his talents and his subject."

Dean Wilson repeatedly emphasizes the individual nature of the problems of improving one's teaching. These are not problems in scientific research, requiring extensive data, statistical experts and analytical procedures. Only I can tell whether or not I am deliberately developing the style best suited to my talents and my subject.

Referring back to the Brooklyn study, I feel that for two additional characteristics I am the best judge of myself:

5. Attitude toward students, and
7. Attitude toward subject

If I am honest, I know whether I am sympathetic toward my students and their problems, actively concerned in helping them, eager to expend the extra time and energy required. Or whether I am aloof, avoid individual contact, and begrudge every minute spent with my students outside of class.

And I best know whether or not I enjoy teaching, whether or not I really like to teach biology. Or am I bored with school, I do not mean fatigued, I mean disillusioned and disgruntled because I am too old to ditch the whole mess and start anew with something different.

With respect to most of the other desirable qualities specified by Riley, one's own opinion is of value but perhaps more fallible. The opinions of others should be actively sought, and need to be given due weight.

To become even a good teacher, let alone superior, I need deliberately to develop my style, to be truly sympathtic toward students, and I must have a genuine love for my subject. And I need to test myself on these points, for here I believe is where self-evaluation can be most dependable.

Evaluation by Colleagues

Critical observation and evaluation of teaching by an experienced teacher is common and accepted practice in elementary and high schools. It is almost unknown in colleges and universities. The practice is considered high schoolish, and this, of course, automatically condemns it for colleges.

In pharmacy, more firsthand observation of classroom and laboratory teaching has probably been made by representatives of the American Council on Pharmaceutical Education since the pharmaceutical time of Dr. Elliott than under any other circumstances. Not infrequently these class visits have been a touchy feature of the accreditation procedures.

I mention them not to introduce argument on qualifications of the visitors, unfairness of observing under abnormal conditions, or unnecessary embarrassment of conscientious teachers. I have been both performer and, some three hundred times, observer. I do not know which role was most embarrassing. I mention these visits to support my impressions on possible values to be gained from one's colleagues, if each of us could get over the idea "what I do with my class is nobody else's damned business."

I believe, too, that both organized and informal discussion of various features of good teaching are more common in school than they are in college. Teachers in colleges rarely exchange and criticize one another's syllabi, lesson plans, lecture notes, laboratory outlines, verbal presentations, or examinations.

For evaluation of two characteristics on Riley's list, I believe a teacher's colleagues rather than his students are best qualified:

6. Knowledge of subject, and
1. Organization of subject matter

Students almost always believe a teacher is an expert in his field. Even one's worst student-enemy will frequently say "he knows his stuff." But I do not believe an undergraduate student is qualified ordinarily to judge breadth or depth of a teacher's knowledge. The teacher, good or poor, knows more about the subject than does the student. And, unfortunately, sometimes teachers are more skilled in appearing than they are in being scholarly.

On the other hand, a teacher's colleagues do have a background for evaluating breadth and depth of scholarship. Even without visits to classes, a colleague forms an estimate of "knowledge of subject" from a teacher's research activities and publications, and from informal day-to-day relationships.

Likewise, on "organization of subject matter" student judgment is not altogether reliable. A colleague has a firmer basis for knowing whether or not a plan of organization is significant and reasonably complete. But, of course, he must see the plan of organization.

A teacher does not seek the opinion of a colleague on knowledge of his subject. He might, however, well ask for advice on his teaching plan of organization. And evaluation of both traits are sought by administrative officers when a teacher is hired, given tenure, and subsequently promoted.

Sometimes the opinions of a teacher's colleagues

are requested by the dean, and at a few institutions a systematic and confidential procedure for obtaining these data is in effect. The University of Washington plan, for example, is reported to be relied on by administrative officers at the time of a teacher's promotion, acquisition of tenure, or when a faculty member believes he is being dealt with unfairly. Evaluation is made by a secret committee which does not meet but reports individually to the University executive officer for academic personnel.

I would think these confidential evaluations to be most valuable for such characteristics as "knowledge of subject" and "organization of subject matter." And most of the specific answers sought are for similar types of characteristic. One trait on the Washington list, "teaching effectiveness," seems to me more often to be evaluated by one's students than by one's colleagues.

For an additional and important teaching characteristic, many of us have colleagues well qualified to evaluate our performances:

8. Fairness in examinations

At Michigan and elsewhere critical analyses of examinations by experts is available for the asking. After consultation, the experts can judge, at least to some extent, whether or not questions are just in the light of the objectives and scope of the course. And they are helpful in spotting ambiguities, irrelevant clues, and stereotyped phraseology. The experts in educational measurement are also willing to discuss grading standards, final determination of grades, and related matters.

Almost no older teacher is going to volunteer criticism of a younger colleague's teaching either to the dean or to the teacher. But almost anyone, if asked by a colleague, would be willing to go over course outlines, laboratory exercises, examination questions, or grading procedures. No one should look upon any such request from a colleague as a sign of weakness.

Evaluation by Students

This is the most debatable type of teacher evaluation. Arguments pro and con are ably presented by Riley. Without outlining them in detail, teachers who favor student evaluation chiefly are ones who have derived personal benefit from student criticism. Administrative officers, who seem to vote quite often in favor of evaluation by students, want the data for obvious reasons. Objections, chiefly from teachers, frequently appear to be based on apprehension about the way in which the deans will use the data.

At Michigan for the past few years periodic evaluations of faculty by students have been made in the College of Literature, Science, and the Arts. This is a large unit, a few thousand students and a few hundred teachers. The evaluation program is sponsored by the administration. Responsible students supervise the mechanics and the students who grade the professors remain anonymous, but the completed tests are turned over to the administration. A teacher can see his papers if he cares to call at the Dean's office.

No poll of faculty opinion has been made, but I believe it fair to assess this as lukewarm at best. Nor is the administration well satisfied with the results at Michigan. Form of the questionnaire has been blamed for part of the dissatisfaction.

The Brooklyn evaluation supervised by Riley and associates has a number of significant features lacking from the Michigan procedure. At Brooklyn the questionnaire seems to have been prepared more carefully. The study was planned and the results evaluated by a group outside the college. Every report was held strictly confidential by the Rutgers team and made available only to the instructor concerned. The only data published were overall summaries which did not expose individual instructors.

These features seem to me to be decided advantages in getting frank evaluations from students, and for maximal acceptance and most profitable use by teachers. They are precisely in accord with the views of Professor Remmers, a pioneer in the field of student evaluation of college professors. He has stated:

> The Purdue Rating Scale for Instructors was not designed and is not meant to evaluate teaching efficiency from the standpoint of the administrator. It is designed to measure the student's prejudices as an important aspect of the teacher-student relationship; important, that is, in determining the learning process. From this point of view it would be a wholly illegitimate use of the scale to use it as a basis for promotion or demotion of teachers.

I believe students are the best judges of at least three of the characteristics listed by Riley:

3. Ability to explain
4. Encouragement to thinking, and
9. Tolerance to disagreement.

Whether or not Ewart Swinyard can explain something in pharmacology so you and I can understand it is not the point. Can he explain it so the student in his Pharmacology 171 can understand it? Only the student in Pharmacology 171 can satisfactorily answer this question.

Who knows whether or not George Webster encourages his students to think for themselves? I don't believe George knows, or Dean Searles. But George's students know.

And who knows whether or not Joe Goodness is tolerant to disagreement on some point in management of retail pharmacies? No doubt Joe thinks he is, and so, probably do Dean Newton and Leslie Ohmart. But a student in Pharmaceutical Administration 476 at the Massachusetts College of Pharmacy really knows the answer to this question.

For at least two addition traits student opinion is probably as accurate as any:

2. Speaking ability, and
10. Instructor as a human being.

If my assessment is reasonably correct, on about half the characteristics enumerated students are able to evaluate their teachers as well as or better than the teachers themselves or their colleagues. In addition, student opinion is valuable on some, perhaps all, of the other traits.

Before leaving the debatable subject of student evaluation, a brief summary of some of the results of the Brooklyn study may be of interest. In analyzing some of their data, the Rutgers' sociologists considered separately teachers in the arts, the social sciences, and the physical and biological sciences.

Overall estimates of science teachers, the third

group, are of greatest interest to us. The following chart from Riley et al indicates on the left the order in which science students at Brooklyn College expressed their ideals. On the right is shown the order in which the characteristics were actually realized, in the opinion of the students. In each column item number one received the greatest number of affirmative votes, item number ten the smallest number.

SCIENCE TEACHERS

Ideal		Actual
Abil. explain	1	Knowl. subj.
Organization	2	Organization
Knowl. subj.	3	Att. subj.
Enc. thought	4	Personality
Att. subj.	5	Att. stud.
Fair exams	6	Speak. abil.
Speak. abil.	7	Tol. disagree.
Att. stud.	8	*Abil. explain*
Personality	9	Fair exams
Tol. disagree.	10	Enc. thought

Let us look at the column headed Ideal. Science students at Brooklyn College valued highly: ability of teachers clearly to explain subject matter; systematic and thorough organization of course material; and thorough knowledge of the subject by the teacher. The students also felt that the good teacher had ability to make the student think for himself; and was enthusiastic about his subject, he enjoyed teaching.

Perhaps of less importance, but desirable, was construction and administration of good tests; and skill in presenting material from the point of view of voice and personal presence. Ranked least essential was a sympathetic and helpful attitude toward the students; possession of an attractive personality making the students desire to know the teacher better; and at the bottom, encouragement of disagreement on debatable subjects.

Now let us look at the column headed Actual. It is interesting to note the situation as the students felt it existed at Brooklyn College. Apparently Brooklyn science teachers were well informed in the fields of their endeavors; were systematic and thorough in organizing their material; and were enthusiastic about their subjects. The students in general felt that these science teachers had satisfactory personalities; and were at least moderately sympathetic toward the students.

As far as speaking ability is concerned, the Brooklyn students ranked their teachers as adequate to poor; and for the most part the teachers were deemed to discourage disagreement on the part of the student. Toward the bottom of the list, in the opinion of the students, explanations were often or usually inadequate; testing was sometimes or mostly unfair; and the science teachers actually discouraged thought on the part of the student.

The most striking contrast between ideal and actual has to do with the ability to explain. Students want teachers who have the ability to give clear explanations. In science, unfortunately, the discrepancy reported is wide between the ideal and the actual, perhaps serious.

The next most striking contrast has to do with encouragement to thought. The students placed reltively high value on that type of teaching in science which stimulates individual thought. Yet the science teachers at Brooklyn seem to have failed strikingly to meet the student demand.

Before leaving these two lists, I would like to add one characteristic which I believe would rank relatively high in the column headed Ideal, providing such a study had been made of teachers in the areas of professional instruction in pharmacy. It seems to me students in the professional courses place high value on the ability of a teacher to relate his subject matter to the practice of pharmacy. Perhaps this would come under "ability to explain", but it is a particular kind of ability to explain.

Where would a heading such as "Practical application to pharmacy" appear respectively in the two columns? Would the actual be as far from the ideal as in the case of "ability to explain?" And how well qualified are undergraduate students to judge the relative importance of this trait or the degree to which it is realized? I will not attempt to answer these questions, but I believe they are important ones in a professional curriculum.

Few if any of us have participated, willingly or otherwise, is as painstaking a study as was made at Brooklyn College. Many of us probably have never been evaluated formally by our students. But if a teacher wishes to obtain student evaluation of his course and of himself, he can easily prepare a questionnaire using Remmers, Cole, or Riley as a guide, and arrange to have it given under circumstances which guarantee anonymity to his students.

If anyone in pharmacy does this, I urge him to devise questions on laboratory procedures and values. The results might be surprising. In May at the end of a year's course, I asked the students to evaluate my teaching, including laboratory exercises. I have decided not to bore you with the results.

Evaluation by Administrators

For most of us, evaluation by administrators turns out to be evaluation by our dean. In a few large colleges of pharmacy a department head may be involved, and perhaps in some the president. But many teachers in colleges of pharmacy deal directly with the dean rather than with a department head, and in large universities the presidents probably do not even know we are around.

How should a dean evaluate a teacher in a college of pharmacy for purposes of promotion and salary increase? On one point I feel strongly. The dean should not depend on student evaluations, either formal (such as the Michigan "lit school" procedure) or informal, if the informal evaluations have been solicited by the dean. Informal evaluations volunteered by students and alumni are another matter. They are bound to influence the overall impression a dean forms of a teacher.

The chief objection I have to administrative use of the results of student evaluations is the effect knowledge of such use has on us teachers. The student evaluations are intended primarily to benefit us. When they are made the property of the dean, elements of distrust and fear operate to reduce markedly the benefit to the teacher.

How, then, is a dean to evaluate a teacher? In units as small as our colleges of pharmacy, it is not too great

a problem. The dean can certainly ask to see the recorded materials used by a teacher: the semester's time table, syllabus, laboratory outline, mimeographed materials, and examinations. A great deal can be learned from these, especially from examinations. And without appearing to do so, a dean can usually learn the opinions of a teacher's colleagues. He can become familiar with a teacher's work-habits, with his publications, and with his attitude toward teaching.

One characteristic of an effective teacher, seldom found on lists and of a nature readily known to deans, is emphasized by President Wriston of Brown University. He calls it "the ability to use help." The type of help President Wriston refers to is stenographic and clerical as well as laboratory help. He maintains that the successful teacher delegates routine tasks wherever possible.

Quite obviously, the help must be provided. And not all administrative officers appreciate the increased efficiency to be gained by relieving teachers of the necessity for much of the routine work they do. It is also true, however, that we teachers frequently do not avail ourselves of help which has been or can be provided.

A teacher types the stencil for and even mimeographs his own examinations. Another spends hours relabelling shelf bottles so they appear neat. A third teacher laboriously writes and addresses by hand notices for a pharmacy meeting at the college. Another copies innumerable abstracts bearing on his research. And another teacher copies endless material to use in his lecture notes when the material could have been typed in half the time by someone else.

I have known teachers who used up great quantities of their time with each of these routine tasks, small duties which girls or student helpers could do better than they. I am guilty of a certain amount of such waste of time as probably are most of us. I think the real reason we do these trivial jobs sometimes is because we would rather putter around with something mechanical than get down to the really hard work involved in developing ourselves as teachers: scholarship and research.

A dean knows whether a teacher has come to him and asked for help on these routine tasks. Of course, a teacher does not always get what he asks for — but he usually gets nothing unless he asks for something! If a teacher is seeking help and makes good use of that help so he is more free to work at his job of teaching, the chances are he will become a better teacher.

All these administrative means of evaluation are indirect; they still leave a dean with the problem of assessing actual classroom performance: the extent of "causing students to learn." But even without classroom visits and polling student opinion, I believe the alert dean of pharmacy is able to get a reasonably correct evaluation of members of his relatively small teaching staff.

We have discussed a dozen or more traits to be found in successful teachers, from the points of view of the various individuals most intimately involved. In conclusion, let us return to the first of these individuals, the teacher himself.

If good is to come from evaluation by anybody, it has to be through improvement in the attitudes, the personality, the techniques, the efficiency of the individual teacher. If he is indifferent to improvement, if he is content to practice self-deception, if he lives a meager life, he is failing his students and he is failing himself.

Emerson asked, "Is not the chief disgrace in the world, not to be a unit; not to be reckoned one character; not to yield that peculiar fruit which each man was created to bear . . . " Our "peculiar fruit" is "causing to learn." As we "cause to learn," may each of us honestly "prove his own work" as exhorted by St. Paul, "And let us not be weary in well doing: for in due season we shall reap if we faint not."

APPENDIX I. SELECTED READINGS

1. Barzun, Jacques, "Teacher in America," Little, Brown and Co., Boston, 1946, 321 pp. A readable commentary on teaching by a prominent contemporary teacher. Gives valuable insight into self-evaluation. (Reprint now available, Anchor, $0.85).

2. Blauch, Lloyd E., and Associates, "Teaching in Colleges and Universities," American Association of Dental Schools, (now) San Francisco, 1945. Chapter 1 contains a section on "Equipment of the Teacher" in which characteristics of the superior teacher are discussed. Chapter 18 has a good discussion of "Appraisal of Teaching."

3. Cole, Luella, "The Background for College Teaching," Farrar and Rinehart, Inc., New York, 1940, Ch. XXV, "The Rating of College Teachers," pp. 557-594. A good summary of studies made prior to 1940 in evaluation of the teacher; includes bibliographic sources.

4. Gray, William S., Ed., "The Preparation and In-Service Training of College Teachers," Proc. Inst. Admin. Off. High. Instit., X, Ch. 8-11, U. of Chicago Press, Chicago, 1938. Four chapters of this book deal with the requisites of successful college teachers from several points of view: the college president, the dean, the teachers themselves. Especially good is the essay by Henry M. Wriston, President of Brown University.

5. Henderson, Algo D. and M. M. Chambers, A.C.E. Studies, Series I, No. 48, pp. 144-164, 1951. Results from a study group which considered "Evaluation of Teaching Effectiveness" are presented. A majority of the participants were administrative officers, and the opinions expressed appear to be somewhat at variance with opinions of many teachers. A good summary.

6. Highet, Gilbert, "The Art of Teaching," Alfred A. Knopf, New York, 1950, 291 pp. Section two of this excellent book outlines in convincing manner the author's ideas on the qualities and abilities of a good teacher. Professor Highet is as well known for his scholarly contributions to radio and magazines as for his teaching.

7. Medalie, Richard J., A.C.E. Studies, Series I, no. 42, pp. 49-54. Mr. Medalie, as Vice-President, U.S. National Student Association, gives a favorable opinion, from the point of view of the student, on student ratings of faculty members.

8. Morris, Fred C. "Effective Teaching, A Manual for Engineering Instructors," McGraw-Hill Book Co., New York, 1950, 86 pp. This manual, sponsored by the American Society for Engineering Education, has a chapter on "Critique of Your Work and Methods." It includes some practical suggestions for self-criticism.

9. Remmers, H. H., "The College Professor as the Student Sees Him," Studies in Higher Education XI, Purdue University, Lafayette, 1929, 63 pp. One of the earlier substantial studies on student ratings of instructors which has served as the basis of many later studies at Purdue and elsewhere.

10. Riley, John W., et al, "The Student Looks at His Teacher," Rutgers University Press, New Brunswick, 1950, 166 pp. A valuable and readable account of a unique study made at Brooklyn College. The authors describe student ratings of faculty members at the college level and explore the implications of the findings.

11. Wilson, Willard, A.A.U.P. Bull., 38, pp.287-295, 1952. Writing on "Physician, Heal Thyself," the author emphasizes the individual nature of the problem of good teaching, and as a guide to self-evaluation presents six "axioms for a teacher."

12. "Report of the Committee on College and University Teaching," A.A.U.P. Bull., 19, Sec. 2, pp. 1-122, 1933. This excellent and detailed report is far from being out-of-date. It presents the concensus of a large number of college teachers on problems connected with improvement of college teaching, ways in which these problems can be solved, and teaching experiments at the college level. It includes discussion of "The Rating of Teachers by Students and Alumni."

APPENDIX II.

CHARACTERISTICS TO CONSIDER IN EVALUATION OF TEACHERS

A. Suggested by Riley et al, "The Student Looks at His Teacher."
   1. Organization of subject matter:
      a. Systematic and thoroughly organized.
      b. Adequate, could be better.
      c. Inadequate organization detracts from course.
      d. Confused and unsystematic.
   2. Speaking ability:
      a. Skilled in presenting material, voice and presence excellent.
      b. Adequate, does not detract from course.
      c. Poor speaker, detracts from course.
      d. Poor speaking techniques serious handicap in course.
   3. Ability to Explain:
      a. Explanations clear and to point.
      b. Explanations usually adequate.
      c. Explanations often inadequate.
      d. Explanations seldom given or usually inadequate.
   4. Encouragement to Thinking:
      a. Has great ability to make you think for yourself.
      b. Considerable stimulation to thinking.
      c. Not much stimulus to thinking.
      d. Discouraging to thought.
   5. Attitude toward Students:
      a. Sympathetic, helpful, actively concerned.
      b. Moderately sympathetic.
      c. Routine in attitude—avoids individual contact.
      d. Distant, aloof, cold.
   6. Knowledge of subject:
      a. Exceedingly well informed in field of course.
      b. Adequately informed.
      c. Not well informed.
      d. Very inadequately informed.
   7. Attitude toward subject:
      a. Enthusiastic, enjoys teaching.
      b. Rather interested.
      c. Rather bored—routine interest.
      d. Not interested, disillusioned with subject.
   8. Fairness in examinations:
      a. Testing excellently done.
      b. Testing is satisfactory.
      c. Testing sometimes unfair.
      d. Testing mostly unfair.
   9. Tolerance to disagreement:
      a. Encourages and values reasonable disagreement.
      b. Accepts disagreement fairly well.
      c. Discourages disagreement.
      d. Dogmatic, intolerant of disagreement.
   10. Instructor as "human being":
      a. Attractive personality, would like to know him.
      b. Satisfactory personality.
      c. Rather unattractive personality.
      d. Not the kind of person you care for.

B. The Purdue rating scale, Professor H. H. Remmers (From Cole, The Background for College Teaching):
   1. Interest in subject:
      a. Always appears full of his subject
      b. Seems mildly interested
      c. Subject seems irksome to him
   2. Sympathetic attitude toward student:
      a. Always courteous and considerate
      b. Tries to be considerate but finds it difficult at times
      c. Entirely unsympathetic and inconsiderate
   3. Fairness in grading:
      a. Absolutely fair and impartial to all
      b. Shows occasional favoritism
      c. Constantly shows partiality
   4. Liberal and progressive attitude:
      a. Welcomes differences in viewpoint
      b. Biased on some things but usually tolerant
      c. Entirely intolerant; allows no contradiction
   5. Presentation of subject matter:
      a. Clear, definite, and forceful
      b. Sometimes mechanical and monotonous
      c. Indefinite, involved, and monotonous
   6. Sense of Proportion and humor:
      a. Always keeps proper balance; not over-critical or over-sensitive
      b. Fairly well balanced
      c. Overserious; no sense of relative values
   7. Self-reliance and confidence:
      a. Always sure of himself; meets difficulties with poise
      b. Fairly self-confident; occasionally disconcerted
      c. Hesitant, timid, uncertain
   8. Personal peculiarities:
      a. Wholly free from annoying mannerisms
      b. Moderately free from objectionable peculiarities
      c. Constantly exhibits irritating mannerisms

9. Personal appearance:
   a. Always well groomed; clothes neat and clean
   b. Usually somewhat untidy; gives little attention to appearance
   c. Slovenly, clothes untidy and illkept
10. Stimulating intellectual curiosity:
   a. Inspires students to independent effort; creates desire for investigation
   b. Occasionally inspiring; creates mild interest
   c. Destroys interest in subject; makes work repulsive

C. Suggested by Henry M. Wriston, President, Brown University, "from the administrator's point of view":
1. Primarily "teaching is to a *large degree a matter of personality* . . . a man's teaching power will increase only as he enriches his own life, as he broadens his own tastes, and as he enlarges his own horizons."
2. Secondarily "the teacher I seek is the one who has resisted the narrowing experience of graduate study and has *continued his liberal education* through the years of specialized training" and throughout his entire career.
3. Favor "*course-rotation* . . . the teacher who rises above mediocrity must deal with a field wider than his own subject."
4. The successful teacher *appreciates "the problems of educational coherence* (of the parent institution as a whole) . . . He should be a frequent intellectual traveler through cognate fields and unabashedly run Cook's tours for his colleagues through his own territory."
5. The successful young teacher must develop "*immunity to neglect*" (by his colleagues) and attempt to gain those qualities of educational statesmanship which will eventually lead to recognition on university committees and comparable bodies.
6. "Successful teaching depends upon a *faculty-student relationship based upon respect and affection,* not upon fear and discipline upon the one hand, or upon sentimentality and sycophantism upon the other."
7. "The successful teacher is one who has not fallen into slow and inefficient habits of doing routine tasks himself, who does not hesitate to delegate small duties . . ., who has *developed his power to use assistants.*"
8. "Teaching requires an *original mind* and the *creative spirit* . . . The greatest single source of academic refreshment is research."

THE PLACE OF AUDIO-VISUAL MATERIALS IN PHARMACEUTICAL EDUCATION

CARLTON W. H. ERICKSON, *Director*
Audio-Visual Center
University of Connecticut

During the past few days you have observed the use of audio-visual materials and equipment as an integral part of your conference activities. Slides have been shown, speeches and discussions have been recorded, charts have been used, and I am sure that more than once speakers have referred to their value in the classroom or laboratory. Your national planning committee believed in the value of audio-visual materials to such an extent that they decided to devote a portion of the organized conference effort to the improvements of competence in their use. I know, however, that members of your group are not neophytes in this field, having produced films of your own and doubtless having had varying amounts of experience with all of the kinds of materials and equipment commercially available. But the very fact that this conference has contributed to such important teaching abilities as stating teaching objectives, planning learning experiences, and testing achievement, means that your ability to use audio-visual materials effectively has already been sharpened because the one cannot be separated from the other. My job today, as I see it, is to focus your attention upon the important aspects of professional competence with these materials because only when they are used skillfully can they take their rightful place in pharmaceutical education.

Just what roles do audio-visual materials play in teaching and learning? Knowing about them and understanding them should help you to predict the nature of the contribution any given type of audio-visual material will make to your teaching success. In the years that I have been a consultant in this field, I have thought of seven distinct roles for audio-visual materials to play. I will give them to you quickly without specific applications to pharmaceutical education, but I know that your field is not an exception.

1. *Audio-visual materials may expand the horizon of student experiences.* While an observer may identify himself with the situation depicted in a slide, filmstrip, radio broadcast, it seems best to reserve this role for the most realistic of all the audio-visual materials, the field trip, models, demonstrations, and the motion picture.
2. *Audio-visual materials provide sources of meaningful information.* This role is played by all materials which consist of pictorial or graphic symbols. Words will do a similar job, but are likely to be less effective for dull or inexperienced people.
3. *Audio-visual materials provide a springboard into desired learning activities by clarifying issues; defining problems, explaining relationships, thus creating interest and helping the teacher to set up subsequent experiences.*
4. *Audio-visual materials may provide teacher and learners in a particular class with a strong motive for learning if they are planned, and produced as a cooperative assignment.* Examples would be producing an exhibit, film, or set of slides or models.
5. *Audio-visual materials provide a kit of instruments for assisting the teacher to diagnose instructional and technical difficulties, or to record and study evidence.* High speed or ordinary photography, tape recorders, and short exposure techniques, are examples of this role. It is the equipment that plays the paramount role here.
6. *Audio-visual materials may play the role of helping the teacher to overcome physical difficulties in presenting course materials.* Examples of this role are substituting a film for a field trip, preserving a slide of a complex drawing; projecting one picture or one piece of material so all may see it at once; or using an opaque projector to enlarge a small original diagram. Economizing on time and effort for the busy teacher, while the last role that I can think of, is by no means the least.

Let us pause for a moment to skim over the entire range of audio-visual materials, before dealing directly with the problem of how to be competent in using them. The materials that I will mention constitute the present limits of your search for illustrative devices. Each has its contributions, its roles to play, in terms of your own personal teaching plans.

FIELD TRIPS
OBJECTS, MODELS, SPECIMENS, DEMONSTRATIONS
TELEVISION AND MOTION PICTURES
STILL PICTURES
- Filmstrip (Sound and Silent)
- Slides:
  - Kodachrome and black and white
  - 2 x 2 inches, 3¼ inches by 4 inches and 5 inches by 8 inches
  - Handmade and photographic
- Vu-Graph materials
- Opaque Projector materials
- Micro-Projector materials
- Study Prints (from a snapshot to a photo mural)

RECORDINGS AND RADIO
GRAPHIC SYMBOLS
- Diagrams
- Maps
- Graphs
- Charts

(also considered by many as audio-visual materials are dramatizations, and bulletin boards.)

Conscientious university teachers like ourselves need to make clear-cut professional decisions about our methods over the whole range of teaching skills. Just what is the nature of the decisions which we ought to make to be competent with audio-visual materials? These decisions fall into five main categories. These are: *choosing the material. getting the students ready, distraction-free presentation, guiding reaction to what is seen or heard, and appraising materials and personal performance.*

The first set of decisions that have to be made deal with selection. Recently in one of our trade journals, THE EDUCATIONAL SCREEN, a new film source book was announced. The audio-visual medical institute of the Association of American Medical Colleges had produced a 269 page directory, called FILMS IN PSYCHIATRY, PSYCHOLOGY AND MENTAL HEALTH. The price was $6.00. Such a compilation of films, slides and filmstrips, developed by yourselves would be of inestimable value in facilitating good selection of materials. However, even if you had such a list of tried and true materials to choose from you should choose the best known items in terms of your own specific objectives and not in terms of a chapter heading or a topic. Above all know what your material will show before you show it and don't hesitate to show only a segment of a film if other material is irrelevant for your purposes.

It is wonderful to be critical, and while you should choose the best material always, don't pass up a good sequence of pictures because there is an error in treatment or content. Show it if it will save you time and assists you, and then develop criticalness in your students by asking them to identify the error or weakness.

The job of choosing an experience for students to engage in is one of the two great responsibilities that a teacher faces, and of course it follows the other big job which is to figure out your objectives. Since no film or slide is in and of itself educative, more decisions are necessary to carry the teaching process forward. These decisions have to do with creating a plan for *readiness.*

Competence with audio-visual materials demands that the teacher relate his materials skillfully and artistically to the past, present, and future activities of his students. To try a variety of methods seems best, but whether you tell a story, ask three or four questions, state three or four issues, present a case study, or give a short introductory talk; whether your plan for readiness is written on a guide sheet, or given verbally; its worthwhileness will be quickly recognized and judged by your students. Some teachers prefer to dictate to the students a few major points of particular interest which will be treated in the material. The points or questions you single out for emphasis will help students to sense what is most important for them. Only your teaching objectives can or should determine what points you so select for special observation. I dislike to prescribe a "one best" technique, since competence depends upon the ability to make good judgments in a variety of situations, but I am convinced that you will find maximum success with the least effort if you raise a significant problem growing out of the students' course activities as a basis for developing readiness to observe the material. This means that the audio-visual experience will be tied specifically to a student's own relationship to that problem. We need to perceive clearly that this recommendation is based on the prediction that "learning how to do" will be intensely more motivating than simply "learning about" something.

We need to be forever mindful of the fact that to surrender control of our learners to a strip of acetate is an irresponsible act. The teacher who was one day willing to surrender his regular class of 120 college students to a film and my operator was displaying a most unprofessional attitude toward audio-visual materials. Any pharmaceutical educator guilty of a similar decision would I am sure merit an overdose of his own drugs.

Competence with audio-visual materials also demands that the teacher make adequate arrangements for physical details to be handled efficiently. If you do not have to operate your own equipment you can devote more time to the more professional aspects of the process, and this of course is to be desired. Whenever possible find out how long a given program will last and start it early enough to finish it before the period ends. True, this applies more to the use of motion pictures, but distraction-free, well-handled presentations of any sort exert positive influences that need to be considered for effective teaching.

No teacher performance with audio-visual materials demands more professional competence than do decisions relative to teacher action during and immediately after the use of any given audio-visual experience. As is the case with the principles of *selection and readiness* the *reasons* you have for presenting a film will determine what your own performance should be. If the film or other material was chosen to contribute to the development of a specific ability, then a practice session should follow the showing. If concepts and important principles are to be developed, then activities involving provocative questioning, discussing, lecturing, investigating, studying, and applying are demanded.

If teachers will base the showing of audio-visual materials upon previously assigned problems the methodology will not only be easier to plan but there will be little doubt about what to do next since the solution to the problem or problems needs to be checked, clarified or advanced to the next stage of action. It seems to me there is no simpler way to make use of audio-visual materials.

This kind of performance by the teacher, however, cannot be taken if the content is unknown before the showing. Adequate readiness plans before, and adequate reaction or action plans during or after the showing, demand personal decisions based on facts not hopes. I always say, "Don't be a sucker! You take the first look."

There is still another aspect of teacher performance that must be brought into sharp focus, namely, that of *critical appraisal.* I have always found teachers ready to find fault with a given piece of material and of course this is a good sign, but the principle of critical appraisal goes further. It demands that the teacher be willing to turn the spotlight of scrutiny upon himself and his own personal decisions. The teacher

needs to ask himself as a minimum, the two following questions:

(1) Was the material good enough to use again?

(2) Were my techniques for using the material adequate?

This is the royal road to improvement, and I for one will admit that the kind of scrutiny I suggest demands a need for courage as well as objectivity. As teachers we should not delude ourselves that audio-visual materials can work alone. In the last analysis, they are vehicles for teaching, which without a master driver may go nowhere in particular.

Before proceeding with the balance of the program I wish to state a few final suggestions for improving competence in the use of all kinds of audio-visual material.

1. Get suggestions on *how* as well as *what* from consultants at audio-visual service centers in your own universities, and check your own performance against the five principles of action set forth here today.

2. Organize new or reactivate former audio-visual education committees for two purposes.

a. To compile and publish a source book of films, slides, and filmstrips, appropriate for use in your own fields of teaching activity.

b. To make a list of needed motion picture films, (either complete productions, or in shorter segments) which need to be produced for specific jobs of motivating, and giving directions or explanations, and assign these titles for production by men assembled here today.

When you are able to keep audio-visual materials in proper perspective by using them as learning activities to be engaged in by students to master specific concepts and abilities definitely known to the teacher, they will take their proper place in pharmaceutical education. As I understand it no one can write you a recipe for compounding a foolproof method for teaching, even with films. This is another case where each pharmacist will have to write as well as fill his own prescription.

FRIDAY DISCUSSION

Q: Are the school of pharmacy films available for sale? And what do they sell for?

A: The pharmacy silent films produced at the U. of Conn. are available for sale. The process of merchandising them has been worked out recently and they are available through the Audio-Visual Aids, Univ. of Conn. The cost amounts to the price of duplication plus 40%. The cost of these approximately 400 ft. films will run in the neighborhood of $90. The sound films are not available.

Q: How far ahead should you book pharmacy films?

A: Send off your order at least three weeks in advance. We can't guarantee to fill every booking with that short notice.

Q: How do you make the titles for the motion pictures?

A: You can buy them directly from a title producing company like Title Craft of Chicago or other laboratories.

Q: Which is preferable for classroom work, sound or silent film?

A: Depends on the individual instructor. Some may prefer to do their own narrating.

METHODS OF PRESENTING TECHNICAL PAPERS

W. H. Weston

Harvard University

What a situation! Here I am in a group in which you have one of the outstanding teachers in the field of Professional Education. Here's this field that you represent, and gathered here are some of the outstanding teachers in the country and I am asked to talk on the presentation of technical papers. Now I ask you – what a situation! Truly! You look over a group like this – there are three possible reactions that they might have. The first one is: "Huh! Knows it all, huh? Just because he comes from the crumbling towers of one of the leading exponents of the poison ivy league he thinks he can come down here and tell us how to do our own job." Even if that were so, there would be something you might gain from someone so brash, so appallingly temerarious that he would attempt such a thing. The second reaction you might have is, "Here's a critic, and the critic, as you well know, having made a dismal failure of creative writing himself, devotes himself to picking flaws in the leading best sellers of the day." But even if that were so, if he came to you as a critic, there might be something to be gained thereby because one does not have to be a prize Rhode Island Red to tell when an egg is bad, and one does not have to be a leading operatic tenor to tell when a note is sour – perhaps pH 1.5. Even if that were so, there might be something you would gain. But already, in this brief contact with these few glances at this battered but benevolent old countenance, you have gathered that I come in the third capacity as that of a coach, and the coach who is now bulging around the equator and couldn't run 100 yards to save his life, can teach others and help them to run 100 yards in less than 10 seconds, and that's good going. So I come in that capacity and you need go not to Freud, not to Adler, not to Jung, not to all the famous psychologists and psychoanalysts to get the motives back of this. All you have to do is look way back in the past and see the Proceedings of the meeting of the American Association for the Advancement of Science – their 68th meeting – on December 28, 1915, and there on that program among some of the outstanding leaders in botany was a paper on the development of a water mole; and that, my dear friends, was the first paper that old Cap Weston ever gave. That paper made all the mistakes in presentation that are possible to make, and after it was over I decided there was more to this presenting a paper than anyone would give you to believe. So I began to study the situation and thereby you have "crusading Cappy", the man with a mission.

I went back determined that I would learn something of this matter of presenting papers and I would transmit it to my students so that others would not go up on to the platform completely unwarned, completely unaware of the requirements of such a difficult problem. So as I look over the papers that I've heard and since that 1915 event I've heard a great many – roughly in that merely 40 years, I have heard around 4,000 papers. Those papers, if you took the manuscript and laid it end to end the way the statisticians do, indubitably those 4,000 papers would reach from here to Jackass Lake, Wyoming or to East Whipple Tree, Maine or to some of the other remote localities that the statisticians are always having things reach to. But out of it I have gained the impression that there are three schools of presentation. The first one I call the R.F.D. School – the Rural Free Delivery. The delivery is there and it is free and neither snow nor rain nor gloom of night stay these messengers in their appointed route. But all too often when the delivery is complete, it is one small copy of an advertisement for liver pills or is one of the comics of the period. The second school is what I call the "A & P" and "Stop and Shout" school. They have the goods – in vast quantity and diversity, but they do not deliver. The third school we shall return to later.

Now as I've looked over the presentation in all these papers, I've come to the conclusion that effectiveness in presenting papers is not so much a gift. We speak of someone giving a paper as if it were indeed a gift – a heaven-sent, an inborn thing which you either have or you have not. But I do not feel it is that. Even though we speak of giving a speech, the success therein is much more often the result of appreciating the requirements of the situation and working hard to meet those requirements. So let us look at the requirements and then let us look a bit on the ways of meeting them. And now comes the reason for this appalling audacity of mine, this unparalleled effrontery of getting up here and talking to you because I too am a teacher. We are all interested in teaching and any of us who can help our students in the matter of presentation of papers, quite over and above the subject matter that we give them, adds something to their ability that is worth while. So it is in that capacity that I stand before you.

If you look upon requirements then of giving a paper, you will depend entirely on the situation. If you're giving an hour's talk, it is a much less difficult and less arduous task than it is to get a short and brief paper across effectively. The 30-minute or 20-minute paper of a seminar or a participation program is difficult to arrange–that too has its requirements. But the most difficult of all are the 15-minute papers that are given on crowded programs in which you and I and our students have participated. So you think over – first the requirements – and then you endeavor to meet them. For a short paper the most subject matter that can be got across is two or three clearcut points. They might be points of development, new

techniques or processes, matters of interpretation. They might be almost anything but they must be fitted to the demands of that short time and to the nature of the audience. You would give a quite different paper if you were giving it before a learned society or if you were a guest speaker at the Ladies Committee for the Rehabilitation of Unmarried Fathers, or something of that sort. So you must fit the paper to the demands of the time and of the group. You will think it out clearly. You will plan it and organize it for that purpose. Now, any paper, if you have planned and organized it, will consist probably of three essential parts: One is the introduction; then comes the main body of the paper and then the conclusion at the end. If we look at those and many of you are familiar with just this process of analyzing and organizing the material to be presented – if we look at it, we find, first of all, that the introduction is of paramount importance. It is so because in it you've got to answer the essential question of what is this about, and when you look at the material and think it over for a paper, apply to it the acid test. So what! Who cares! Or to put it in more formal academic language–what the hell of it! Because someone has got to listen to you and unless you can get across the reason for it, it has no reason for being. So, the introduction is of paramount importance. First for that point and second because there is this shock effect which Cannon first worked on which other physiologists have studied carefully since – the adrenalin effect, the shock effect, mike fright, stage fright, buck fever, and it hits different people in different ways. It hits the same person differently at different times. One reaction you have noticed perhaps in yourselves, certainly in your students, is the paralyzing effect which this has upon some. They get up to deliver the paper, the eyes glaze, the throat completely closes, they start in, "this substance . . . ." – it's a horrible thing to see and it is a ghastly thing to experience yourself.

The second type of reaction from the adrenalin coursing through the human system is what I call the hyperkinetic effect. And the chum comes up on the platform and he plunges into point three. He says, "The effect of this material is so," and he dashes from point three to point four; he goes back to point 2½. He finally remembers point one. It's dynamic; it's riveting – but it is very hard indeed to follow.

Another effect is what you might call the short circuit – the "spoonerism," and you're up here and out of you is flowing this stream of communication, but something goes wrong and you don't know what you've said, but you have this terrible feeling that you have short circuited somewhere. Some of those are positively riotous. I remember one when years ago I taught in Cleveland at Western Reserve University. I went down to Overland to a conference and there was a man, an expert on transportation there. And Overland is only a few miles out of Cleveland. And he said, "Here in Overland, you used to feel isolated; you were away from the center of things but now you're closely in touch, thanks to the trusses and bucks." He paused a minute. He knew he'd pulled a spoonerism or a short circuit somewhere, but he couldn't for the life of him locate it. Then there was one in my own field of biology. He was eloquently expounding the development of a group, the evolutionary development of this group and he said, "In this case the evolutionary development was not by slow step-by-step progressive stages; it was in one swell foop".

There are all those things then – those things that will suddenly come upon you in the introduction. So the introduction is of great importance. The student – and you will counsel him in this regard – should have the introduction so firmly in mind that in spite of the adrenalin effect, in spite of all the things that can happen like tripping over cords, lights going out, something being wrong with the slides – in spite of that he will be able to get up there and he will be able to get started on the introduction. And after he has got going for just a minute, the heart begins to beat more normally, he has greater command of his faculties and he's all set. So, to know the introduction so cold that it can be handled even under the most difficult circumstances is a highly important step. The ideal introduction, then, answers this question of "So What?" and briefly it will be something like this: "Although ergot has been secured in the past from the natural material in the fields, coming as it does from Omsk, and Tomsk in Russia mostly, recently work done in our laboratories has shown that it can be cultivated in vitro and that this fungus thus grown will yield the essential pharmaceutical materials in a pure and highly productive form. It is of this work I wish to tell you this afternoon." Some introduction like that then, that gives you a brief background, gives you the essence of it, tells you the "So What?" and the reason for being, and then you're off.

The second part, of course, is the main body of the paper and that will vary. Whether it is the treatment of some process, whether it is a survey of some situation, the matter will vary, but in all it's bound to have the meat to be presented effectively, compactly and with due regard for the nature of the audience and for the exigencies of the time. So you will study that; you will organize it with great care; you will have it in the most effective possible form; and there your students come to that first great decision – shall I read the paper or should I present it verbally – and I plead with you, help them to realize the essential importance of giving the paper more or less spontaneously and not to read it. The great advantage of a read paper is that everything is in perfect order. It's in perfect balance; the wording is precise and effective; the transitions are correct; the emphasis is exactly as you want it to be, but it has that deadly effect – a read paper inevitably becomes a dull and lifeless thing. There is not one man out of a thousand who can read a paper and have it carry with it the impact of personality, of enthusiasm, of a real feeling for the material. So I think it is worthwhile for you to help your students to give the papers more or less extemporaneously and not to read them. The advantage of that is that it is a living thing. Here locked within you is this vital center that thinks and achieves, and somehow you've got to get across from in here, to all of us the material that you have in mind that seems to you important. If you look at the basic philosophy of this it is that that makes us so much higher than animals. It is that greatest gift – communication of ideas

of abstract and beautiful and important things that makes us what we are. So take it seriously. If it can be done by the voice, the voice is the most effective, the most marvelous medium of communication which we have. If then, it is given a chance, and the thing is so effectively worked out that it can be presented verbally, presented by voice without reading, it is well worth doing. The use of slides for this purpose is very helpful and we will come to that in just a moment. The use of suitably organized numbers which will be bold enough so that even if the light – all too frequently the speaker's light has to be turned out because it hits them in the eye in the front row, and when you see some of your esteemed colleagues sort of peering up at you this way, you know something's wrong. So you put the thing out, then you can't see your notes. So you've got to have your notes down cold enough so that even if you lose page two you can still carry on, and there are various methods. Some prefer cards, small cards. Cards are fine, but cards can be shuffled. In fact, that's the essential feature of cards, so if they get shuffled the first thing you know you are on point four when you thought you were on point two and that's highly disconcerting. Paper has the advantage of giving it to you in form where you can follow it, but paper rustles and it's big and it gets in the way.

Each of you will have your own way and your students with you will work out their own techniques – but some guide is very important because you do not learn the thing by rote; otherwise then it becomes a game, lifeless and mechanized; but you will at least have a guide so that you can follow down through it.

So when you have it organized and are getting into the body of the paper, one of the things that immediately must be considered is loudness and emphasis and it all depends on the hall and you can tell by watching those in the back row, and if those in the back row are sort of like this, you're not speaking loudly enough. If those in the front row are sort of getting back that way, you're speaking too loudly. So somewhere in there there's a golden mean of loudness – enough that will reach every member of the audience and yet not berate them and batter the ear drums until the ear drums are moving in and out like bubble gum, which is a frightfully fatiguing thing in a long paper. The next thing you might consider with your students is the question of rapidity of delivery. Now some believe in the machine gun technique, and they just pour it on so fast and you can get a tremendous amount across, and if you're covering factual material and the students are with you, they can stand a rather rapid pace; but in ordinary speaking it is better to speak fairly moderately slowly with occasional pauses and not wear them down. The machine gun delivery has the advantage of getting a very great amount over but it wears the audience. They get ill at ease; they've been battered just like a steel riveter. It's riveting but it's tiring. When they go too slowly on the other hand, it's as if you were watching a pole vault and you're trying to help the guy. You say, "Come on, Joe, come on, come on." – You're wasting foot pounds of energy trying to get the guy over the hump. And he gets stuck on a word – so that somewhere in between there is the suitable speed and action of your presentation.

Now the question of attention. There are two schools of thought here. One I call the Fire Hose Pokers, and they pick someone in the audience; like the Ancient Mariner, they say, "This is average man number one; I will give it to him." They bore in on that poor chum and he thinks, "Why did he pick me up? I'm just an innocent bystander, why does he pick on me?"

The other which is greatly favored by your campaign orators is what I call the park spray technique, and you've seen them. They go down the streets in Cambridge with a spray machine and they spray the trees and the baby carriages and the cars and people passing by. They spray everything in the vicinity, and that procedure is to stop here and wobble it around a bit and spray everyone in the vicinity. Then, the thing that bothers some people is the matter of diction, enunciation and all of those things that you learn in speech classes. And do not think me iconoclastic if I tell you that I sincerely believe those are not of the essence in the effective presentation of technical papers. I've been to too many international congresses when the broken dialect of one member or another still got across effectively. I've heard them from the far corners of this country with the lovely drawl of Texas, to the southern method of speech, to the twang of Maine. You don't have to be of any effective school of speech to get across your technical material. So, I would counsel a student to be himself, to speak as he naturally does, and if he's from the South and he says "I-dri-otic acid", why brother, you let him say "I-dri-otic acid." It's the natural way for him to do. And if he's from out in the mid west and he says "ceegarette and *ice* cream" and some of those accents, why those are perfectly all right. The thing that you can help them with is on scientific terms and technical terms. There is a tendency for the beginner to soft peddle those. He's not quite sure of his pronunciation, he's not quite sure of himself on them. So he tends to sort of slur over them. Plead with him not to do that. Plead with him to bring them out clearly, because whether they are mispronounced or not is not the important thing. The important thing is to get the thing across from one brain to the other by this speech method of communication – and so long as the audience gets it they won't hold it against the man if in his section of the country he pronounces it quite differently from the way they were trained in another part of the country. So I feel that that is important and I've heard some of the most utterly fabulous lectures that it has ever been granted man to hear. When I was a graduate student at Harvard, word got around that a visiting lecturer from Germany was well worth hearing and he was speaking in the elementary zoology course. He was Willie Kukental from Breslau. He had an accent that was priceless. It would have been worth literally thousands on the stage. But his enthusiasm, his interest for his subject utterly made up for any differences and I can still–that was so many years ago that it is difficult for some of you to look back to that time – I can still remember some of his lectures. One on whales. He was an expert on whales. He was one of these little, short chaps, you know, dueling scars all over like this. Short crew-cut–

a little stocky fellow – he got up there and he said, "Gentlemen: Gee, Whiz! Do Zay Sleep? Yes, but on ze bottom, no, because they are as you remind, mammals and zay have, as you remember, lunks." You never forget that; you see, the stuff was there. Some of the students were having a field day taking notes. He came to the phylum, echina dermata, which is a star fish and related things, and the boy in front of me wrote down "a kind of tomato". And I've heard some perfectly remarkable sermons and lectures. The French, when they really get going are priceless. There was one man and he was talking, and he said, "Can ze leopode changée his coat, can ze Ethiopian changée his skin?" And it took you minutes to know that he was talking about the leopard changing his spots and the Ethiopian changing his skin. And this famous British divine that I've heard lecture – he said, "He that has yars to yar, let him yar" and we finally got what he was talking about. But in any case, no matter how extreme the accent is, if the spirit is back of it– and that brings us to the utter, essential thing in any presentation, and that is the sincerity and enthusiasm of the one who is speaking.

If you don't feel any interest in the material that you're talking about, how can you expect anyone else listening to you to have any interest or enthusiasm for it? If you think this is literally the most exciting stuff and you are so glad to have an opportunity to tell them about it, that magic something is meted out to those who are listening to you and it gives that supersockaroo, that quintescent whammy that just makes the difference between an ordinary talk and something that's got something. You'll remember those. So that's the important thing. Far from that is the diction and pronunciation and schools of elocution. That's the thing to try above all to have, and if you don't have that sincerity inside, believe me it won't come out because whenever you are speaking to an audience, there are two streams of communication. There is the one of words which is getting across the facts in the material and there is this subtle additional secondary one. You can't put your finger on all that's accomplished but somehow when you listen to a speaker perhaps he's talking about photosynthesis, for Heaven's sake, and you think, "I trust that guy, I would like to work with him as a graduate student." How do you arrive at that conclusion? Or you think, "I wouldn't trust him any further than I could push the Flat Iron building. And how do you arrive at that also? Somehow there's this secondary stream of communication that tells a great deal, and if there is in you sincerity and belief and enthusiasm in what you are talking about, that somehow will get across, and it will do a great deal to mitigate and alleviate any slight inadequacies in the smoothness and effectiveness of the presentation.

Well, a little showmanship is not amiss, you know, and some of the past masters, some of you here, have showmanship as well as good organization, as well as effective presentation and enthusiasm and sincerity. And that showmanship I have seen in a number of lectures. There was once when my father was in medical school in New York City, way back in the very early days. And that man was in anatomy; he was going through the bones of the head. The bones of the head are a mess, as you well know. Bounded on this side, it articulates with so and so, such and such muscles attached to it. Then he came to the sphenoid bone. He held up this revolting little object and he said, "This, gentlemen, is the sphenoid bone. Damn the sphenoid bone!" He put it down on the table. And the students all looked it up. They remembered the sphenoid bone when nothing else was remembered. And there was another chap there. And he was a bit of a showman too. He would come in here like this. He would have a handkerchief over his eyes. He wouldn't say a word. He'd start groping around like this. The student's eyes would be fixed upon him . . . "that gentlemen, is the difference between abdominal diagnosis without x-ray and abdominal diagnosis with x-ray." They never forgot that one. So a little showmanship is not too bad. But it must not be carried to the point where it becomes spurious and artificial.

The great Copeland at Harvard whose readings made history used to give these Christmas readings that are known all over the United States, and once he was about to give a reading, he said to the janitor of the hall in which he was to speak that night, "Now when I come up on the stage, yank out the light switch, leave it out while you count ten and then shove it in again." So he comes on the stage. He's just about to start when the lights go out. Then they come on again, and he said, "Now what divine omnipotence knew that I was going to read to you from "The Light That Failed?" That was spurious, that's artificial. It's carried to too great a length. But any natural showmanship that goes into your presentation is all for the good.

So, the next thing of interest is slides and other artificial aids as an aid to presentation. Now you choose your slides very carefully – you choose them for subject matter and you carefully consider the number, and it's a shock to the student when he first begins to give papers to realize that the rate is just about one slide to two minutes of talk. so if you are giving a 15 minute talk, seven slides is just about the maximum. And you and I have been through it; we've seen a man come in with one of these long slide boxes like this. You know you're in for it. He's going to give a half hour lecture and it's going to resolve itself into a sort of a flicker. This is the mountains as we approach them; this is a view of Rumpus Ridge, from Jackass Creek. This is the second view of Rumpus Ridge, flick, flick, flick – It's a very hard strain, so the most you can use effectively is about one slide every two minutes, or one slide every minute and a half. Now the nature of the slides is highly important. It's a great temptation if you have written a book and in it you have put effective plates and tables and things that crowd the maximum amount of presentation of factual material into the most compact form, great temptation to use slides from such a source. Perhaps in some cases it can be done but all too often it makes it impossible for those who are way over in the back corner, way over here, to see much of anything that's on the slides. The slides have to be gauged to the size of the hall, the size of the screen and the position of the audience. And the nature of the slide is a highly important thing. Let's look at a few as examples. Now that one, is a life cycle and it's totally out of your field, but so help me, if you look at that thing for just a few moments–

when, as and if it comes where you can see it, there's a most beautiful presentation in very compact and effective diagrammatic form of the life cycle of one of the lower fungi, and just a minute or two of study and you've got the whole thing. It's a slide like that that's very helpful. In the next slide you see a contrast – look at this which is the development of another fungus. It's from the hands of one of the greatest masters in my field of mycology whom every American knows – Dr. Thaxter, but it is so crowded. It's perfect in its rendition, it's exquisite in its craftsmanship; every detail is perfectly correct, but it does not carry the message for presentation as a slide. Now, a slide can also show, very effectively, stages in a process of physiological or biochemical nature and this is one when you are working on the influence of hormones in the four successive stages and the reproduction of the water mole. And the whole story is this – takes a minimum of explanation – those in the back of the room, those who can't hear a word or two because someone coughs will nonetheless get the whole story. And some slide like that is helpful and can be adapted in principle at least to the type of presentation you have in mind. In the next one–now if you want to show a process, a physiological process, here again a little showmanship in the slide concerned is an excellent thing. Here is the conventional treatment. And here in these flasks are growing some of the slime molds with which we work. And they thrive on certain substances and you can see how in these two flasks they've spread and developed and increased in bulk, and here much less so. But take the next slide for example. That has all the factual material and it has a bit of showmanship. This was to show that these slime molds would use cellulose and those letters – myxo for myxomycete are cut out of pure filter paper cellulose and placed on top of a non-nutrient agar plate. And the slime mold starts at one corner and it crawls along and it absorbs and ingests the M and the Y and the X and the O. And when you show that it has been vividly portrayed that the thing will make use of cellulose. So a little showmanship is helpful even in slides. And certainly the brevity, the clarity, the effective punch gets the thing that you're after across in the most compact and effective form. And the next slide – now you can do really a remarkable amount of explaining complicated matters by the use of diagrammatics, simple direct, well formulated slides. Here's the migrating stage of this mold – it's a slime mold again, one of the very lowest of them, and we got this one to take up red color by getting it to eat the bloody red bacillus and the color stayed in there; then we cut off the anterior end and grafted it on to the white one and we grafted the white end on to the pink one and they flowed together and healed and the thing crawled up and then later it organized. And right off you can see it's the anterior end of that that makes the stalk. It's the posterior end that makes the mass of spores up on top of the stalk, and a slide like that gets across – even complicated physiological things – very effectively. The next slide – now when you show a thing like this, however effective it may have been in the book, the only desirable effect I can see that it might have is to lead the audience to go and buy the doggoned book so that they can really see what you're talking about, but they certainly won't get it from the slide. But if they sit down with a book and with a magnifying glass, they'll probably get it. But as presentation in even a group of, let us say, 30 people, that's unfair. The next slide – if you're trying to boil something down for a group this size, you shouldn't make it much more complicated than that, truly. Curves and graphs and things – they get the overall picture, but actual details have got to be very compact and on a large enough scale so that they can be read easily at the very back of the room. In the next slide, we come to the matter of spotting, labeling and orientation. And these standard size slides – the old fashioned glass type – are 3¼ by 4 inches, and if you think that over there is just one position out of four in which that slide may be shown, that is correct. And it's up to you to spot it in the lower left which will be the upper right when he puts it into the lantern so that it will always go into the correct position. The square slides – the early 3¼ by 3¼ like this, or the modern 2 by 2 – one position out of eight is correct. And you must label it so that even an operator working under difficulties, and they frequently do work under difficulties, cannot fail to get the slide in the correct position. In tissue such as this, a square slide can be put in backwards, forward, upside down, crosswise and it's still okay. Tissue is tissue and the orientation of it is not important. But take the next one, for example. Now there are seven ways that are incorrect, but one way in which it's correct, and it shows that your operator is a good operator because he put it in the way it was spotted. I've had chaps slip it over me by looking at the thing and saying, "He's got this spotted wrong, the poor chum, I'll save him the embarrassment and I'll turn it around." This shows another thing – in the F.B.I. in Washington they have files and files of fingerprints and those fingerprints are in place there. And they serve a purpose. But they are not in place and they serve no good purpose at all on a slide. So when someone throws on a slide of the time it takes for a certain reaction to be gone through when it's covered with fingerprints it sort of detracts from this, so it's a thing that you will avoid.

Now comes the question of pointing to the slides. In a very big hall they have this ghastly invention of a flashlight with a little arrow and you take that thing and swing it around and the arrow points. Here's a little bright arrow on the slide you see on the screen but if you are like most human beings like ourselves, your hand gets to shaking and the arrow is bouncing all over the place. You know, you feel like a fool. I always get it against my hip like a machine gun hold the thing tight; then another method is the conventional pointer and the pointer is pretty good, but you mustn't stop and turn to the slide and orient yourself. You've got to know that slide so cold that you can be talking about it to the audience and yet point to the slide without having to hunt around for the thing. Some of my colleagues are masters of this. There was a Canadian mycologist – knew the slide so cold, would be reading – sorry to say she always read her papers – but nonetheless they were well organized – she would tell that the chromosones were now in the pro phase; bing, she put her finger right on it. And some of them get to be very dramatic. Now Couch at Chap-

pel Hill, North Carolina — Couch has a technique with the pointer that is like D'Artagnan — in the Three Musketeers. He pins the little tail right there, for you to know. Now also there's a matter of signalling with slides. We're very fortunate here because it's a relatively small hall and the operator, in addition to being a very kindly and efficient man, is near enough so he can hear me, so that all you have to say is "the next slide, please" and he has it. But in some, way back there there's a sort of fighting tower and you are working by remote control. So they give you a push button. And you get excited. The poor chum up in the fighting tower sees a light flash on or hears a little imperceptible buzzer and he shoves in the next slide. You aren't ready for the slide, so in a fury of frustration you begin screeching. Those wires are hazards, they're booby traps. You're talking, you see, and you go on, you kick the wire, get it tangled up in your left hind foot and you pull it out of the socket in the wall and then everything is shot. I prefer, if it is still possible to reach the operator by voice, just to say "In the next slide", and you'll be surprised how well even a student, or unskilled operator will get that simple direction. There's something about that that cuts through and you'll get it, quite apart from a skilled operator such as we have tonight. There is then the matter of the slides, the organization of them, the number, the referring to them and one thing of paramount importance, that is, the slide is to show the audience something. It is a means of getting across some of your material. It is not something to go into a huddle with, and the unforgiveable thing is for the person talking to turn around and "Here we have a . . . . ". He goes into a huddle with the slide, he turns his back on you; you're excluded from all that has taken place Heaven's knows what they're getting away with between themselves and it leaves you feeling frightfully frustrated, and along with that there's the matter of his speaking directly to you, whether he's talking about slides or not. Now obviously you're talking to the audience whether you're talking about the slides or not, so you don't turn around and half talk to the slides, you're talking to them as human beings and you're going to try to keep a fairly even delivery for them. The thing that's comparable to talking only to the slide is what I call the Seaman Curve Technique, of voice in presentation. And the Seaman curve is the most beautiful curve in all architecture — it's the wave curve, it goes like this. And some people start in so that you can hear them so clearly. They say, "In the development of these cells . . . . " and you can't get the point, it goes way down you can't hear a thing. Then they come up again and say, "However, on the other hand" and you get all the however's and and's, but's and unimportant things, and the essential point is way down there. The only thing worse than that is what I call the Humphrey Bogart or Secret Adversion Technique. The secret operative technique, you know, where Humphrey Bogart sticks a cigarette inside his face. He walks down the street and passes the news man. He's an undercover agent and he says out of the corner of his mouth, "The convoy sails at dawn." Well you don't try and talk to an audience that way. It's frightfully arresting but unless you get it it's lost. So all those things in relation to slides and so on, you will bear in mind, and you'll have your students bear in mind. And thereby everybody profits.

Now, after the body of a paper has been presented effectively in this way, why then finally comes the conclusion. In the conclusion, it is highly important that you do not let down, and there is a thing in which you can help your students greatly. I think it is well to recapitulate briefly. Following that introduction that I gave a moment ago, it would be effective to say, "I trust the work that I have shown you and the material this afternoon has convinced you that in our laboratories in vitro we have been able to grow the ergot fungus and attain in pure and concentrated form the material that we are seeking in pharmacy. I thank you." If you do that, if you sort of sum the thing up, then I always say, "I thank you" at the end. Why, I do not know except that I sincerely want to thank them. They listen to me. To me, this material is important, it's exciting and here these people that I greatly admire have given me their time and their interest for 15, 20 minutes and now I do indeed thank them and also from the point of view of the lantern operator, the head of the program, the chairman and so on, it puts a period on the end of it and if someone just trails off you never know where you are, but if they finish strongly and then say thank you, then you know where you are. So there's the general set up. Now what can we do toward helping the students attain this? Because it's highly important here. He's going to represent your laboratory when he gives the paper. You wouldn't let that fellow fuss with an electron microscope and mess up a thousand dollars worth of equipment without giving him some guidance. Similarly you'll give him some guidance when he goes and represents your laboratory when he gives a paper. So how can we help him? It seems to me one of the first things is that he should realize that preparation beforehand is of great importance. Never underestimate even a ten-minute paper. In fact, I think a ten-minute paper is much more difficult in its requirements than an hour paper. Indeed, Woodrow Wilson, who was a very effective although academic speaker — someone asked him, "We would like very much to have you speak before our group. How long would you require for preparation to give us a 30-minute talk?" And he said, "Oh, about a week." "A week! How long would you require to give us an hour's talk?" "Well, a couple of days." "Really! Well, how long would you require to give us a ten-minute talk?" "Oh, two weeks at least." "Good Heavens, how long would you require to give us a two-hour talk?" "I'm ready now." So the difficulties of a brief paper are very severe. So urge them not to underestimate the requirements of even a short paper in a non-technical program with a group of the church or the Grange or something of the sort.

Then, another point. They work it out, they organize it with great care because if it isn't clearly thought out it cannot possibly be clearly presented. Then they time it. It's a horribly time-consuming and lengthy job to prepare a short paper — it truly is. In my opinion, the proportion is more than 100 to 1, easily. If you're going to give a one-hour thing you're going to put in 100 hours preparing it, at least. So they get it ready, they organize and they think, "I know the

material, I've worked this out, it shouldn't take me long to prepare it." But to prepare it for the requirements of that particular program, of that particular group, is really a serious thing. If they realize that in the first place, accept it, and are willing to put in the time toward it, the first half of the battle is definitely won. Then, additional preparatory precautions are helpful. These meetings that so many of our students present papers at are pretty rugged affairs. They go on for days. You don't get sleep enough. You celebrate; the rooms are filled with smoke and the student has so many hazards to meet. Tell them how important it is that they manage to keep the men awake during the paper. The room is filled with smoke, you have to shovel a portion of it out to get your way up to the lectern, frequently, and people are packed in, the air gets stuffy and after a while you'll see them popping off not only in the middle rows and in the back row but right in the front row. If the student can somehow keep them awake, it's well worthwhile. Because, while delivering by twilight sleep is said to be painless, nonetheless, scopolamine and nembutal and what not leave no memory of the blessed event and for a paper, the delivery of a paper, that's not so good. So, remind them also that if people get up and leave immediately after their paper, it's no aspersion on them. It's just that there's some other meeting way over on the other side of the campus and they've got to get over there fast if they're going to take part in it or hear the paper. And similarly, the student should not be disappointed if there's no discussion after his paper. He's worked on it, he's worked hard, it's fascinating stuff. So what of it? The chairman says, "Is there any discussion?" Dead silence! the poor chap feels frightfully left out but as a matter of fact they're hoping the program will get through on time for once, for Heaven's sake, so they can get some lunch before they go to the next meeting. Let him realize that, and reassure him also that the real discussing is done in the corridors and coffee shops over coca colas and cigarettes. That's when you can really get to the bottom of matters with those who are interested. And they'll come up to that student and tell him, and they'll say, "I'm much interested in that paper you gave; one of my men is doing a similar thing; may we sit down and talk about it?" That's the discussion that counts. Very frequently when the chairman calls for discussion, what happens is that some little chum gets up – he's not on the program; he wants to get in something about a trick he's got in making streptomycin. This paper, for heaven's sake is on ergot. It has nothing to do with streptomycin. "I was very much interested in the paper and we have been working in our laboratory – a very interesting process we've worked out, I think Mr. so-and-so would be interested in . . . . " And he's off for 20 minutes or as long as he can get away with it on something he's done that has no relation to the paper whatever. So cheer the poor chum up if anything like that happens to him, and if you're chairman, take a small velvet-lined baseball bat and . . . . .

The chairman says, "We will now hear the next paper on the program. It is the development of mycto haplan in the fungus . . . Mr. Shmo. Is Mr. Shmo here?" Brother, you are caught, that is it. That is the equivalent of the whistle blowing on a ski jump. If you've ever been ski jumping, that is the moment when it blows, you're off, and there's nothing that can save you then. It's the equivalent of the old-fashioned highwayman. Nowadays they take a dirty looking gat and shove it into your ribs and say, "Stick 'em up Mac, and hand over your dough." But in the old days, this picturesque character used to bounce out from the shrubbery. He would level two Percheron-size horse pistols in the general region of your sternum and say, "Stand and deliver." "Mr. Glock or what not, you're in for it" is the equivalent of "Stand and deliver." So tell him as he comes up from the side of the room or wherever he is to take a deep breath and cough a couple of times, get the old diaphram working; if necessary, hu-m-m-m do something like that. It's all the difference between being sort of frigid because you've been quiet for so long and suffering and getting action quickly. So you can hustle with things like that. There are a few more things. They should be ready for emergencies. Anything can happen. The bulbs and lanterns burn out. In the darkness of the room, you hear the projectionist drop a box of slides. You pray that it is not your slides. Then, you're trying to point to the slide. You fall off the stage. I did that once in a lecture room. It was a sheer drop of three feet. I was the recipient of spontaneous applause on the part of 350 students, who enjoyed it hugely. So I scrambled back. But those things can be very disconcerting.

Another thing that will help them is to have rehearsals. Now some of them are your assistants and they're already doing some teaching and there is nothing so helpful for giving a paper in a scientific meeting or such a formal group as teaching the modern, American student. The modern American student is the best training ground in the world. He isn't overwhelmed with the fictitious formalities of Europe. I've had European students – the minute I came into the room rise and bow. The professor was something out of this world. They look up to him. The American student regards him as a good egg after all, but they're willing to try things out on him, and that is excellent training. The happy heckling of uninhibited students is the best training for giving papers I know. I had one group – they were marvelous. They were an especially good bunch. It was toward the beginning of the war, the future loomed dark ahead of them. They thought, "Boy, let's take it on the chin and get a kick out of it." So when they went to the medical school, I followed their progress there with great interest, and they kept up the happy work they had begun with me, and Henderson, the physiologist, was lecturing and Henderson was trying to point out that chance enters into even the most scientific things. He said, "Even in fixed scientific fields, chance is always operative. Why gentlemen, I might drop dead in the middle of this lecture". "Ray, ray. . . " The students gave him the biggest hand he'd had in a long time. And these same fellows that I'd had such a wonderful time with, when they went to the medical school, there was one sadistic professor there and he'd read over aloud before the whole class the results of the previous quiz. So he's going down the list, you know, and they vowed that they would cure him of this revolting habit. So he was reading down the list. He said, "Adam, A, Adamson,

B, Arnold C, Brown D. He was going down like that. He got to Brown. Brown got up and said, "Oh, no, professor, not that"; he pulls out a very big revolver—boing! Two of his companions, utterly dead pan — one takes him by the feet, the other by the head and they lug him out of the room . . . Then, there was this professor at the medical school and he told them that they would go into the matter of urinalysis, next time, so would the class please bring samples. So they came in the next time and each one had his little four-ounce bottle discreetly veiled in a paper or something of the sort, you know; and the professor was just about to start the lecture when the door was flung open at the extreme rear of the lecture hall. This little chap, this little student who had been in my class came staggering down the aisle with a five-gallon carbuoy. So, all these things are helpful, very helpful in giving a student poise, the ability to meet emergencies, the ability to handle the situation when he gets to giving papers, gets to presenting things. And he will study the presentation of others. And you've all had the experience. You've read papers by Pumpernickel and Glotz, and they were wonderful papers. Then you hear Glotz give a paper and its lousy. You get an impression either Glotz can't present a paper or that Pumpernickel is the brains of the team. So you learn by hearing these papers, you learn by watching the presentation of others. And students can profit greatly by that; they can profit by poor presentation. They begin to realize, "Now what's wrong with that; why didn't that get across?" They begin to see, "This is good; why is this so good? Why is that so clear?" I sat there and that just developed before me like a film, like a motion picture. Sequence after sequence of ideas with a minimum of effort on my part were absorbed by me. How did he do it? So gradually, not by mimicry, but by selective absorption a student takes in these things. You help him and guide him. You help him by rehearsals if he's going to meetings. You get together in groups; you time it; you criticize how effectively he got it across, whether he took too long in the introduction, whether he dragged over this, whether his wording was not effective. And out of that, gradually, gentlemen, emerges a group of students that will have the third method of presentation which I commend here. That is what I call "special delivery." And may it always be yours. Thank you.

Discussion Sections

on

PHARMACEUTICAL CHEMISTRY

PHARMACY

PHARMACOLOGY

PHARMACOGNOSY

PHARMACY ADMINISTRATION

PROFESSIONAL ORIENTATION

Pharmaceutical Chemistry Section

Monday, August 16, 1954

L. M. Parks of the University of Wisconsin opened the meeting with a welcoming address.

No formal presentation was given. G. E. Cwalina of Purdue University was the discussion leader of the day.

The discussions for the remainder of the week were arranged to be confined to the following subjects:

Organic Medicinals
Drug Analysis
Quantitative Analysis
Biochemistry
Inorganic Pharmaceutical Chemistry

The discussions for the day were:

Course Planning
Course Objectives
Course Outline
Lesson Planning

SUBJECT:—

OBJECTIVES OF ORGANIC MEDICINAL PRODUCTS

Speaker — Pierre Smith
Rutgers University

General objectives:—

1. Dependent on individual students with regard to his desires for:
   a. Retail pharmacy (Many Instructors forget that the majority are going into retail pharmacy.)
   b. Hospital
   c. Graduate work
2. Ability of the student.
3. Curricula is also a factor — it is not static and constant revision is necessary.
4. Time allocation is a factor.
5. The Instructor should be the judge of the scope of his course in his individual subject.
6. Consultation with other men to determine what the subject matter should be.
7. Students should also be considered in determining what the objectives should be when going into retail, industrial or graduate work.

Specific Objective in Organic Medicinals

1. Nomenclature
   Example: I.U.C. important
   Trivial and generic not too important
2. Scope goes from hydrocarbons to heterocycles.

With a list of objectives it is easy for the Instructor to:

1. Organize his course.
2. Make more efficient use of his time.
3. Be a more effective teacher.
4. Allow him to choose best teaching techniques.

Objectives in Organic Medicinal laboratories are not necessarily the same as in lecture work.

Speaker — Arnold Marcus
Rutgers University

SAME SUBJECT

Factors which determine the scope a course should include:

1. Boundaries between courses sometimes limit scope.
2. Unnecessary duplication should be eliminated.
3. Objectives should be listed and summarized.
4. Course should prepare student with a good knowledge of modern organic medicinals.
5. Course should force student to use his mind in inductive reasoning rather than memorization.
6. Student must realize what is expected of him.
7. Objectives should be discussed with other faculty members teaching related courses.
8. The final decision should be up to the Instructor giving the course.
9. Objectives should be revised constantly, each semester, only on minor revisions. On major revisions, only after a clear perspective of past results and what lies in the future.
10. Major changes might include revisions in curricula of courses which have not proven satisfactory.

DISCUSSION PERIOD

Q: When should Organic Medicinal Products course be given?

A: Some say terminally and others as a pre-requisite to pharmocology.
   1. The course objective determines when the course will be given.
   2. It should be given the same time as dispensing which is also a terminal course.
   3. Should precede dispensing pharmacy.

Q: Should it be taught as a pure chemical course or should recognition of the fact that it deals with biological substances be taken into consideration?

A: Should not be a chemical course but taught in conjunction with biological sciences.

Discussion: The question was asked as to who had set up the objectives specified in the book by Webster and Blauch. The statement was made that only the individual Instructor can make up his own objectives for a specific course but that this book lists general objectives that can apply to any course. The comment was made that since anyone can use his own objectives, what is the value of having a set of objectives?

The answer was given that objectives should be the same regardless of what school one is in but that the method used to attain these objectives would differ.

Final results seem to be that all have the same objectives but that the wording may be different and the means by which this is done may vary with each Instructor.

Q: How does the Instructor translate his objectives into the objective of the student?

A: 1. The student must be made to realize that to reach his objectives he will have to do a lot of studying and amass a large amount of information before the objectives can be realized.
2. The student should be made to realize that the result of his learning will be of aid to him after he gets out and not something to be forgotten by him.
3. The comment was made that unless objectives are laid down there will be chaos in giving and trying to pass on to the student the objectives.

Q: How often should the curriculum be revised?

A: It should be gone through annually and necessary adjustments made.

This concluded the discussion on objectives of Pharmaceutical Organic Chemistry.

DISCUSSION OF COURSE OUTLINE

A course outline is a plan which allows you to arrange your material methodically.

You must teach to the capabilities of the student.

A concise summary of your outline should be given the student. Included in this summary should be the major topics to be covered which put the course in proper perspective for the student.

The comment was made that one of the weaknesses of passing out outlines to the student is that it may make him feel that all he has to do is learn the facts in the outline and that is all.

PREPARATION OF OUTLINE

1. You must have objectives. Decide which main topics should be covered.
2. Each subject should lead into one of more complex nature.
3. Each topic should be divided into sub-topics.
4. Amount of time to be devoted to each subject should be determined and adhered to.
5. A committee should be set up to see how each course fits into the curricula without excessive overlapping of courses.

PRINCIPLE AIDS IN COURSE WORK

1. Select topics with relative value to the complete range of topics in that area.
2. It is more important to treat a few topics thoroughly than many subjects scantily.
3. Select topics of greater value to pharmacy.
4. Ask yourself the following questions with regard to your course material:—
   Is the subject matter you chose necessary to achievement of objectives of the course?
5. Is the subject matter within the realm of the student or is it too advanced for him?
6. Should material previously learned be expanded upon?
7. Is the material of interest to the student?
8. Questions to ask yourself to determine if laboratory is necessary to accompany the course:—
   a. Will a student learn new techniques?
   b. Is the student capable of understanding the lecture material without a laboratory?
   c. Does the laboratory supplement the lectures?
   d. With cost involved is the laboratory justified?

SUBJECT:

OUTLINES IN BIOCHEMISTRY

Speaker — Jack E. Orr
University of Montana

He believes outlines are very important and feels everyone should have access to them as well as all other syllabi. This reduces duplication and places proper emphasis in course work. The objectives should be lain down by a committee and then given to the individual Instructor to outline his course. The course should be primarily for students entering retail pharmacy.

The Instructor must decide which phase is most important and allot sufficient time for each part.

Course work should be revised continuously.

An outline should be given to all Instructors of prerequisite courses indicating what will be covered and thereby permit proper preparation of the student and eliminate duplication.

DISCUSSION PERIOD

Q: How detailed should an outline be?

A: Should be sufficient so that duplication does not arise.

Q: Should the outline be the same for student and faculty?

A: Two different outlines should be used. Student outline should be in language that can readily be understood.

SUBJECT: LESSON PLANNING

Speaker: Nathan Levin
Howard University

Lesson plans should include the following:—

1. Notes.
2. Laboratory experiments.
3. Demonstrations.
4. Homework, etc.
5. Visual aids are important.
6. Reading assignments.

Lessons should be planned in advance. A plan generally becomes stabilized after repeated use. However, it should be revised as new material is added.

Speaker: Willis E. Moore
George Washington University

SAME SUBJECT

A lesson plan is a means of aiding the Instructor to present a better lecture.

A lesson plan should include how to motivate the student to understand what you wish to present. This includes methods used in explaining.

A lesson plan should include a summary of the lecture. Bibliography should also be included as well

as a listing of instructional aids such as charts, movies, etc.

A lesson plan makes it easier for a substitute to follow your lecture work since he can then readily see how your work is being presented to the students.

It is more complex than an outline in that it tells you how, while an outline tells you what.

Comment was made that it is impossible to follow a strict outline and one must be flexible in his presentation of material.

Tuesday, August 17, 1954

DISCUSSION LEADER: Jack E. Orr
University of Montana

SUBJECT:
METHODS OF CLASSROOM DISCUSSION

This session was to be limited to how classes are conducted in the following:

Organic Medicinal Products
Inorganic Pharmaceutical Chemistry
Biochemistry
Drug Analysis

Speaker — Pierre Smith
Rutgers University

Smith uses informal lecture groups since he has found that a discussion group is not practical with a large class. He uses informal lectures by encouraging questions that are pertinent to the subject. He uses many instructional aids such as:

1. Colored chalk (helps in pointing out specific items)
2. Molecular models.
3. Hands out flow sheets.
4. Movies are also of value.
5. Slides.

He feels that students should learn "type" structures rather than individual compounds. He directs his lectures to individual students as this brings in a personal relationship and motivates the students' interest. Questions are permissible during lectures if the question is pertinent to the material.

SPEAKER — George L. Webster
University of Illinois

Webster feels that lecture representation is still the best way of presenting material. If he is not presenting a point clearly he does not mind being interrupted. If a lot of material is to be given it is better to have it mimeographed so the student won't waste too much time trying to copy it. The outline should be given out piecemeal so that the student will take an interest in the work being covered and not file it away. He feels it is better to classify Organic Medicinal Products by therapeutic action rather than a strict chemical classification.

Webster does not use any textbooks but relies on the N.N.R. and Modern Drug Encyclopedia. He feels that proprietaries should be used so the student can see the actual product that is being discussed.

To acquaint himself with the students he invites each one to his office for a ten minute talk sometime during the semester.

SPEAKER — Wei-Chin Liu
Southern College of Pharmacy

SUBJECT:
DR. LIU GAVE DEMONSTRATION OF USE OF VISUAL AIDS

Liu feels that each topic under discussion should have an outline with the pertinent information outlined. This should be pasted in the notebook of the student and leave room for the student to write under the pasted sheet additional information given in the lectures. He feels the use of slides makes it easier to place complicated formulae on the board.

The projector can also be used to indicate certain physical concepts such as the use of Polariscope. This shows what one should see when examining a sample.

The viewgraph can also be used in visual aids. It is an overhead projector which has the advantage of continuous tape. The projector is in back of you. If it is difficult to take notes the material should be mimeographed and given to the student before the lecture begins. It can also be used as a means of giving short quizzes.

SPEAKER — Austin A. Dodge
University of Mississippi

Dodge stated that he is willing to stop any time during lectures to answer questions. He has informal lectures interspersed with recitations. He does not hand out sheets as he prefers to use the textbooks. He feels that Organic Medicinal Products should be taught on a chemical basis since most schools do not have pharmacology until the senior year and therefore the student would not be able to understand the subject matter if it is taught strictly from a biological viewpoint.

One of the purposes of Organic Medicinal Products is to acquaint the student with material he will meet up with in pharmacology. He feels that outline sheets make the student feel that this material is all he is responsible for. Dodge feels that the student should know basic types of structures and not have to memorize individual structural formulae. He said the formulae should be placed on the board before class to eliminate time during lectures. He passes around samples of what he is talking about. He does not use too many visual aids in presenting his material.

SPEAKER — G. E. Cwalina
Purdue University

SUBJECT — SOME OF THE METHODS USED IN HIS COURSE IN BIOCHEMISTRY

Cwalina stated that he uses short exams because they keep the student from falling behind. He uses open book exams about 50% of the time. Outlines are used to summarize the material. The outlines should not be too detailed and there should be room for comments. He feels the students should learn to look up material themselves in literature. He changes his textbook every four years to prevent stagnation and he feels it keeps one up to date. One of the study aids he uses are questions which are to be found in the textbook.

DISCUSSION PERIOD

Q: What type of questions do you ask on open book exams?

A: Example – Look up Vitamin A and write structural formula and discuss functional groups. This type question tests the ability of the individual to use the information found in the textbooks.

Q: What methods can be used to motivate the student?

A:
1. A question sheet is given students in which the students grade the Instructor. This is given out after final exams or prior to the finals. From this, the shortcomings of the Instructor can be learned.
2. Interest in a course can be maintained by use of many visual aids such as slides and diagrams.
3. Give organic chemistry with pharmaceutical aspects.
4. Use of projects.
5. Type of student is important in determining what type of method should be used in teaching.
6. Assign reading assignments from Journals.

Wednesday, August 18, 1954

DISCUSSION LEADER: Paul Jannke

University of Connecticut

SUBJECT:

METHOD OF LABORATORY INSTRUCTION

A laboratory is an imperative tool in any course, especially with a course that lends itself to such work.

Laboratory instruction is a modern part of education and in a sense can be considered as a visual aid. It encourages students participation and reviews the material to which the student has been subjected in the lectures. Each laboratory experiment should be used to indicate how previous information can be used. These facts should be brought to the knowledge of the student. He should be taught to apply the theory learned in lecture to the laboratory.

Where does the Instructor fit into the picture? How does he use the laboratory work in evaluating the students' abilities? This leads us to the question for today, namely, Methods of Laboratory instruction.

Information is given to the student before laboratory work to acquaint the student with what he is to do.

The discussion is whether the fill-in type of laboratory report is beneficial or not.

COMMENT – This type of form is good since the student may stray from the actual information that is desired. The student can readily see what is required of him. Originality is introduced by making place for him to make his comments known.

COMMENT – This type of fill-in form is not too valuable for upperclassmen as the student should be permitted to collect the laboratory work in any way he wishes. This permits the student to express his individuality in comparison to the fill-in sheets. The use of fill-in sheets distracts from the organization ability of the student. However, it is a good idea to have a desired form listed but the student should use his own judgment in organizing his information.

COMMENT – The fill-in form does give the students a lesson in showing them how a good report should be.

Q: Are we putting too much emphasis on results or should we be more interested in the theory and procedure that is involved?

A: The student must learn to weigh and measure accurately; therefore, precision is important.

Each assay should be thoroughly discussed with regard to principals and theory involved.

The laboratory should be fully attended and questions concerning the work be asked of the student. You can get a greater evaluation of the students than by using just a grade obtained from the results of the assay.

The attitude of students depends upon what they are going to do after they leave school. Those with the lowest interest are those going into retail pharmacy. This is overcome by talking to the students and showing them the value of this information after they leave.

Q: Should there be an honor system for unknowns?

A: Yes, we should trust the students more.

The comment was made that physical handicaps should not be held against the students.

SPEAKER – G. E. Cwalina

Purdue University

SUBJECT:

USE OF LABORATORY IN BIOCHEMISTRY

The Biochemistry course was originally a lecture course only. At the present time it is given in conjunction with a laboratory course. Principles are laid down which must be followed in the laboratory. Directions are given how reports should be written up. Many of the experiments are of the test tube type and the students are not graded too accurately. Much of the laboratory mark is arrived at subjectively considering the opinion of the laboratory assistants.

Q: What should the ratio of student to Instructor be in a laboratory?

A: Between 15-20 students per Instructor is a reasonable ratio.

Q: How do you motivate the students?

A: There is not too much need to motivate the student in biochemistry as the large majority take a keen interest in this subject.

Q: How do you make a graduate student a good assistant?

A: The Instructor should call them in and tell them what is expected of them and what they must do. Graduate assistants should perform the experiment before they go into the laboratory so they will be familiar with the difficulties and be able to answer questions intelligently.

The graduate assistant must not be too friendly with students. In addition, he should be given the opportunity to take a lecture once in a while and prelaboratory instruction should be left to the assistant after he is well informed on what to cover.

In grading papers the assistant should be informed by the Instructor on what type of answer to accept.

The comment was made that the professor should not criticize the assistant too much as in many cases

it is his own lack of interest that causes difficulty. The responsibilities are up to the Instructor to see that the assistants are doing a good job. The difficulty is that a lot of assistants are placed in positions where they have no interest, such as a pharmaceutical chemistry major in pharmacognosy. The comment was made that it is of value to the assistant to be rotated in different subjects if he is going into teaching.

A seminar should be used to orient the graduate assistants and the problems should be discussed.

The comment was made that laboratory quizzes should be used to determine if the student understands the principles involved. Technique and cleanliness are also important factors in laboratory work as well as theory.

The question was raised as to the part instrumentation should play in drug assay. It was decided that until they become economically feasible, there is no place for them. The comment was further made that you are obscuring much theory when you use instruments which are beyond the comprehension of the student.

Thursday, August 19, 1954

DISCUSSION LEADER: George L. Webster

University of Illinois

SUBJECT: EXAMINATION AND TESTING

The only way to tell what a teacher is teaching is to examine the type of question he asks on an examination. The objectives of professional chemistry courses can only be attained if the objectives set for basic chemistry courses are met. Only then, can one go on and achieve the objectives of a course such as organic medicinals. One should examine the questions and ask himself if the question covers any of the objectives for which the course is being taught. The Instructor should correct the examination as he has a clear idea of what type of answer to accept. Questions such as "discuss this" are not very good. Examinations should not be composed in haste. If one takes time in making an exam, it leads to a better test and also it is easier to grade. Webster does not object to a student answering questions fully and giving any other information pertinent to that question.

The following discussion was based on some of the questions used in pharmaceutical chemistry.

Q: Should a student be forced to learn the specific details of some particular assay? Does this type of question judge the ability of the student to apply a principle to a problem situation or does it not?

A: It is not good because if you do not recall the exact procedure, you cannot answer the question.

This type of question is justified on an open book exam or to be given after the student has just completed the assay. It should not be used as a final examination question.

Q: What should be considered a good number of experiments in a semester?

A: Between 15-20 experiments.

Q: What value is obtained by forcing a student to do arithmetic on a final exam?

A: The procedure is the important factor, not actual numerical numbers, and arithmetic should be done with homework problems.

Q: How much credit is allowed for the procedure even though the answer may be wrong?

A: On certain questions the answer should be right or wrong. However, it depends on the question.

Q: If you are interested in methods only should you deduct for wrong answers if the method is right?

A: It depends on the objective of the question. It must be decided whether the method or answer is important for that particular question.

The comment was made that as the course progresses more accuracy should be required. Consideration should be taken of the pressure involved in calculating during an exam as well as the time factor in checking the answer.

The opinion of the group seems to be that the method is going to be stressed and the answer is an individual problem.

Q: What percent of the course should be devoted to exams?

A: About 10%.

Q: How should this 10% be broken up?

A: The number of exams depends upon the Instructor.

The comment was made that weekly exams are better and the results are more valuable. It is not too desirable to cover too much work in one exam.

Webster listed six factors and the percent of each which an exam should be expected to test.

1. Recall of factors	30%
2. Understanding of principles	25%
3. Vocabulary	10%
4. Problem solving	20%
5. Laboratory methods	10%
6. Knowledge of literature and subject	5%

Q: How are the percentages arrived at?

A: It depends upon the type of course you give. With various courses the distribution may be different. Each Instructor should decide the amount of weight to be given for each individual course. The total number of exams should have this type of breakdown and each individual exam need not be of this distribution.

Q: Should previous exams be posted for investigation?

A: Yes.

Q: Is it fair to ask the student to find errors in a question which contains many?

A: This type of question is no good as it forces the student to memorize exact details. In addition, the student never knows how many errors are to be found.

Other means of evaluating students can be asked besides examinations, such as assigning reports. The use of the library is important but it is not easy to instruct the student on the proper use of the facilities since time generally is not available.

Q: It is desirable to give the student a choice of questions?

A: It is not a good practice since it destroys a common basis for evaluation among the students and leads to less valid measurements. This runs counter to common practice as more will use it than

not.

Q: Is it a good idea to tell students about the format of the exam?

A: Yes. It is good to let students know what to expect so that they will know how to study for the exam.

Q: What do you think of open book exams?

A: Open book exams approach the ideal. It forces the student to use textbooks and to understand them.

Q: Are multiple choice questions good or bad?

A: Good.

Q: Are matching questions good or bad?

A: They are valuable but limited in scope. Multiple choice is most flexible and the best.

Q: How can an open book exam be objective?

A: The student cannot look up everything. However, if he has to look up too many things he can never finish the exam. This type of examination is most generally used with discussion type questions.

Q: Is the only purpose of an exam to test achievement?

A: This is the paramount reason. However, a test should also be instructional.

Q: How should you divide up examination time?

A: They should not be given all at once but should be distributed over three or four exams per semester.

Q: If you have only 2-3 exams a semester you are forcing the student to cram. If you give a short exam every period you are forcing the student to learn as he goes along without cramming. Which is advisable?

A: Various circumstances are involved. It depends on the motivation of the student. Cramming is ineffective in studying. The student should be mature enough to realize he can't learn everything the night before.

Q: How does one determine what the laboratory grade should be?

A: Grades, attitudes of the student, opinion of the graduate assistants, etc.

Q: How does one grade a laboratory course like biochemistry?

A: One is not actually interested in evaluating laboratory work. You are interested in evaluating the knowledge of lectures in a course like biochemistry.

A Selected Bibliography on the Teaching of Courses in Pharmaceutical Chemistry

Quantitative Analysis and Drug Assay

1) The Objectives of Quantitative Analysis in the Pharmaceutical Curriculum. James, A. E., Am. J. Pharm. Ed., 3, 234-7 (1939).
2) Should Separate Courses Be Offered in Drug Assay and Quantitative Analysis. Parks, L. M., Ibid., 5, 42-7 (1941).
3) Correlation of the Teaching of Dispensing Pharmacy and Quantitative Analysis. Plein, E. M. and Kelly, E. A., Ibid., 6, 248-250 (1942).
4) The Pharmaceutical Syllabus and Quantitative Pharmaceutical Chemistry. Taub, A., Ibid., 8, 52-3 (1944).
5) A Critique of the Syllabus Outline of Quantitative Pharmaceutical Chemistry. Gisvold, O. and Wilson, C. O., Ibid., 9, 47-50 (1945).
6) Quantitative Chemistry and Quantitative Pharmaceutical Chemistry. Kelly, R. S., Ibid., 9, 51-4 (1945).
7) In Revising Curricula What Should Be Done About Quantitative Chemistry and Drug Assay Courses? Worrell, L. F., Ibid., 18, 66-74 (1954).
8) General Objectives in Quantitative Analysis and Drug Assay in the Pharmacy Curriculum. James, A. E., Ibid., 18, 74-80 (1954).
9) The Importance of Drug Assay Courses to Pharmacists in Industry. Johnson, F. F., Ibid., 18, 83-92 (1954).
10) Should Quantitative Analysis and Drug Assay be Given as a Unified Course? Kelly, R. S., Proceedings of the Teachers' Seminar in Pharmaceutical Chemistry, Cushing-Malloy, Ann Arbor, 1952, pp. 62-5.

Organic Medicinal Products

11) A Course in the Chemistry of Organic Medicinal Products. Hartung, W. H., Am. J. Pharm. Ed., 6, 78-84 (1942).
12) Laboratory Work in a Course in the Chemistry of Organic Medicinal Products. Sumerford, W. T., Ibid., 6, 84-9 (1942).
13) The Teaching of Organic Pharmaceutical Chemistry. Harris, L. E., Ibid., 6, 250-2 (1942).
14) Teaching the Chemistry of Organic Medicinal Products, Didactic Instruction. Keagle, L. C., Ibid., 13, 304-8 (1949).
15) Laboratory Instruction in the Chemistry of Organic Medicinal Products. Gisvold, O., Ibid., 13, 309-20 (1949).
16) A Discussion of "Laboratory Instruction in the Chemistry of Organic Medicinal Products". Bang, H., Ibid., 13, 321-5 (1949).
17) The Scope and Content of an Undergraduate Course or Courses in Organic Pharmaceutical Chemistry. Johnson, H. S., Ibid., 13, 326-32 (1949).
18) Discussion on the Scope and Content of an Undergraduate Course or Courses in Organic Pharmaceutical Chemistry. Matthes, J. D., Ibid., 13, 333-5 (1949).

19) Organic Medicinal Products, What should be the Proper Balance and/or Correlation between the Chemistry and the Pharmacology? Leuallen, E. E., Ibid., 15, 43-6 (1951).
20) Organic Medicinal Products, What Should be the Proper Balance and/or Correlation Between the Chemistry and the Pharmacology? Semeniuk, F., Ibid., 15, 47-9 (1951).
21) The Importance of Heterocyclic Chemistry in the Teaching of Organic Pharmaceutical Chemistry. Soine, T. O., Ibid., 17, 194-7 (1953).
22) The Importance of Heterocyclic Chemistry in the Teaching of Organic Pharmaceutical Chemistry. Burckhalter, J. H., Ibid., 17, 197-200 (1953).
23) The Objectives, Prerequisites and Scope of Organic Pharmaceutical Chemistry. Webster, G. L., Proceedings of the Teachers' Seminar in Pharmaceutical Chemistry, pp. 69-72.
24) Experiences in Teaching Organic Pharmaceutical Products. Gisvold, O., Ibid., pp. 81-82.
25) Teaching the Chemistry of Organic Medicinal Products Using a Pharmaceutical Classification. Burckhalter, J. H., Ibid., pp. 83-84.
26) Teaching the Chemistry of Organic Medicinal Products Using a Chemical Classification. Hager, G. P., Ibid., pp. 87-91.
27) Laboratory Work in the Chemistry of Organic Medicinal Products. Data, J. B., Ibid., pp. 92-94.

Biochemistry

28) The Role of Biochemistry in Pharmacy. Green, M. W., Am. J. Pharm. Ed., 4, 224-8 (1940).
29) Biological Chemistry, A Basic Pharmaceutical Science. Lewis, H. B., Ibid., 10, 352-4 (1946).
30) Biochemistry in the Pharmacy Curriculum, Optional or Required Subject. Lewis, H. B., Ibid., 11, 119-25 (1947).
31) Biochemistry in the Pharmacy Curriculum. Bauer, C. W., Ibid., 11, 125-31.
32) A Discussion on the Subject Matter for Biochemistry. Wilson, C. O., Ibid., 11, 131-4 (1947).
33) Scope, Objectives and Applications of a Course in Biochemistry. Lewis, H. B., Proceedings of the Teachers' Seminar on Pharmaceutical Chemistry pp. 62-5.

Inorganic Pharmaceutical Chemistry

34) The Course in Inorganic Pharmaceutical Chemistry. Orr, J. E., Ibid., pp. 38-43.

Miscellaneous

35) Pharmaceutical Chemistry in a Flexible Curriculum. Webster, G. L., Am. J. Pharm. Ed., 4, 233-40 (1940).
36) Inventory for a Pharmacy School Faculty Member. Johnson, H. S., Ibid., 8, 275-7 (1944).
37) The Survey has Looked at the Pharmaceutical Curriculum. Blauch, L. E., Ibid., 12, 677-97 (1948).
38) Suggested Methods for Achievement Testing. Harris, C. W., Ibid., 14, 69-76 (1950).
39) The Good Teacher. Pella, M. O., Ibid., 14, 419- 28 (1950).
40) Methods and Aims of Modern Scholarship. Rice, G. P., Ibid., 15, 17-22 (1951).
41) The Education of Teachers of Pharmaceutical Chemistry. Blauch, L. E., Ibid., 17, 169-82 (1953).
42) The Chairman's Address, Section of Teachers of Chemistry. Green, M. W., Ibid., 18, 62-4 (1954).
43) Co-ordination of the Courses in Pharmaceutical Chemistry. Parks, L. M., Proceedings of the Teachers' Seminar on Pharmaceutical Chemistry, pp. 107-112.
44) "The Pharmaceutical Curriculum". Blauch, L. E. and Webster, G. L. G. Banta Publ. Co, Menasha, Wis. (1952).
45) "Effective Teaching, A Manual for Engineering Instructors." Morris, F. C. McGraw-Hill Book Co., N. Y. 1950.

Pharmacy Section

Monday, August 16, 1954

THE PHARMACY TEACHER

Louis C. Zopf
University of Iowa

It is most gratifying to be able to participate in this, the sixth and largest Seminar ever conducted by the American Association of Colleges of Pharmacy. The large number in attendance is significant of the sincere interest on the part of the administrators of the Colleges of Pharmacy and of the personal desire of the faculties to improve their teaching technique. In this group, we will confine our efforts and attention to the teaching of pharmacy. Here we will share ideas, techniques and experiences in teaching with our fellow colleagues. Formal presentations will be limited to the presiding chairman for each afternoon or for each division, and their remarks are to be of a provocative nature intended to serve as a springboard from which to carry on organized but open discussion. It is desirable that we confine our efforts to the "why" and "how" of teaching and that each of us contribute to the discussion.

The problems of the teacher of pharmacy do not differ basically from those of any other teacher. We are committed to transmitting the best and most comprehensive information that we know. Ours, however, is a specialized area. We must present professional information and facts to young people for them to know, to value, to believe, and to stimulate inquisition in their minds for further and continued exploration. The ability to interpret facts rather than the mere knowledge of them should be emphasized. We should avoid, insofar as possible, encouragement of rote memorization of the facts; rather, we should demonstrate the methods by which these facts can be applied to increased learning.

Pharmacy is a highly complex, interesting and challenging subject to teach. Our task is truly the responsibility of teaching the profession. We orient the student to the profession, lay the foundation for his understanding of the principles of pharmaceutical processes and techniques, combine the skills and information acquired in the basic science courses and bring them to focus in a person with skills, abilities and judgment for the compounding, dispensing and understanding of pharmaceutical products.

As in the teaching of any other subject, there are certain elementary, fundamental facts which must be presented. They are the foundation for the future learning process. It is frequently the fundamental material which is most difficult to teach. For example, the arithmetic of certain pharmaceutical computations is of little significance to the beginning student but important to the professional man for his future competency and proficiency.

The majority of our students now enter pharmacy with increased information in the sciences of physics, chemistry and biology. Increased competency is, therefore, demanded of the teacher of pharmacy as a result of this change in our curriculum. The teacher must be able to direct the student to apply principles gained in a basic science to the needs of pharmaceutical operations. This places a greater need for increased competency on the teacher of pharmacy as it means this individual must be able to dramatize and fit the principles gained in his basic sciences to the needs of pharmaceutical operations. His instruction should first outline the principles of the procedure and then proceed to train the student in the implementation of the technique.

Pharmaceutical processes and principles are most challenging. Fundamentally, they are basic scientific principles applied to the production of pharmaceutical preparations. A good teacher can place the student in a position where he will call upon his basic science foundation to support the professional application of his efforts in the production of pharmaceutical products. There are new facts to learn, new values and uses to apply. The good teacher can present these so that they will be a challenge to the student and continue his desire to learn.

Teaching pharmacy has an added problem not generally shared by the teachers of other subjects found in our pharmaceutical curriculum. It is frequently necessary to overcome conditions and undesirable habits acquired in the laboratories and classrooms of the basic sciences; for example, untidy housekeeping, careless techniques, unprofessional appearance, impressions and attitudes. The pharmacy teacher needs constantly to stress professional ethics, professional pride and to train an individual with professional finesse.

Our objective in pharmacy should be to develop an increased understanding on the part of the student as to the physio-chemical principles and laws which apply to pharmaceutical systems; to help him analyze and interpret these aspects, to increase his familiarity with the instruments which are used as an aid in the studies of pharmaceutical systems; to aid him in expanding his pharmaceutical technology and to develop his technique and professional ability to a point where he will be competent to understand and interpret any pharmaceutical problem.

The development of a professional man is the ultimate objective of all teaching in colleges of pharmacy. In pharmacy, the professional course of the curriculum, we have a culmination of all knowledge and skills. Here, we must integrate and consolidate the information possessed by the student and teach him to translate it into the ability of compounding and dispensing medicines to the sick. The basic sciences, general education, business operations and jurisprudence, all contribute to the development of a person possessing pharmaceutical proficiency, expert-

ness and judgment. Can there be a more important place for professional teaching?

PROFESSIONAL ORIENTATION— A CHALLENGE FOR ALL TEACHERS OF PHARMACY

L. F. Tice

Philadelphia College of Pharmacy and Science

The subject of professional orientation is surely receiving its full share of attention at this year's Teachers' Seminar. In addition to this afternoon's program, we have two – and possibly three – evenings which are set aside for Dr. Sonnedecker and his group who will conduct a Workshop in Professional Orientation. One of our problems this afternoon is to make every effort to keep our discussion in the area of *how* to teach the subject matter in this field rather than to explore course content and the other broad aspects of professional orientation. These, the workshops— tonight and Wednesday – will consider in detail.

In some respects, we are placed this afternoon in the position of discussing the best route by which we can arrive at a destination as yet unknown. This, however, may not prove too great a task for pharmaceutical educators for there are some among our critics who claim that we have had considerable experience in such seemingly aimless pursuits.

In order that we shall have some common understanding of the term Professional Orientation, let us adopt for the purposes of our discussion this afternoon this area as defined in *The Pharmaceutical Curriculum* by Blauch and Webster. The authors suggest that the following courses are very useful in accomplishing the objectives of professional orientation:

a) Orientation in Pharmacy,
b) History of Pharmacy,
c) Professional Communications,
d) Ethical and Professional Relations, and
e) Public Health.

Most, if not all, of us here will accept these as comprising the list of formal subjects contributing to the professional orientation of the pharmacy student. The course in Public Health serves purposes other than its usefulness in professional orientation. Its syllabus and the manner in which the course is taught largely determine whether it is primarily applied bacteriology, professional orientation, or both.

Before we begin our discussion of how best to teach these subjects, I should like to direct your attention to the problem presented by our raw material – our entering students. At one time, many years ago, almost all pharmacy students had a considerable amount of professional orientation even before they entered college. In those days, it was considered quite proper that all boys fill their spare time with suitable employment. Even parents of some means considered it an important part of a child's training that he learn to work at an early age. As a result, most young men entering the study of pharmacy did so after several years part time employment in a pharmacy. The pharmacist in those days took his obligations as a preceptor quite seriously. Not only did he screen out undesirable candidates, but he spent countless hours indoctrinating and counseling the boy whom some day he would send to college with his endorsement.

The problem of professional orientation then was not as great as it is today. Young people in this generation fill their spare time in high school with extracurricular activities – sports, music, building 'high-fi" sets, and so on. This is as it should be for leisure is an important part of living and part of our accepted social pattern. Many today enter a college of pharmacy with only a very superficial knowledge of the nature of the profession. For such students, professional orientation is extremely important since some do not know enough about pharmacy to judge whether they will be happy in its pursuit. It is a tragedy, indeed, for any student to waste time in the study of something he will come to dislike. On the other hand, the proper professional orientation will motivate even more strongly the student who should become a pharmacist and make his scholastic efforts in this direction not a burden but the fulfillment of an important goal.

Some few students enter our colleges of pharmacy already disillusioned by their contact with some pharmacist who himself has lost all self-respect and professional integrity. These are tragic cases but the good teacher sees in them his greatest challenge. He must disabuse their minds and consciences and undo the evil done by a scoundrel who has degraded both his profession and the idealism of youth. The rewards for this accomplishment by the teacher are great indeed.

Taking into account these changes over the past few decades together with our increasing professional opportunities, it can be seen that professional orientation and the courses supporting it offer exciting possibilities to the teacher with vision and dedication. In this area of instruction, these attributes in the teacher are prerequisites for success. Let us then agree on the superlative importance of professional orientation among our educational objectives. As such, it well deserves the emphasis which this Seminar has given it.

The Seminar Committee, in developing the plans for this discussion period on Professional Orientation, suggested that we follow the plan of an open forum discussion. As your discussion leader, I have already given the accepted definition of the scope of Professional Orientation and the courses supporting it. This is item No. 1 on the agenda supplied me by Dean Zopf who is chairman of the Pharmacy Discussion Group. I should like to suggest that we restrict our discussion of how to teach to these four subjects:

Orientation in Pharmacy
History of Pharmacy
Professional Communications
Ethical and Professional Relations

The question of *when* these should be taught cannot be separated from *how* since one must of necessity influence the other.

From this point on, we shall try to guide the discussion along the lines of the agenda for our meeting. If we succeed in doing nothing more than raising issues or questions that can be answered later in our workshop, we at least shall have made a start.

DISCUSSION LEADER – L. F. Tice

Orientation in Pharmacy

From the general discussion on this topic it could be concluded that this course was essentially a first year course. It should be utilized to familiarize the freshman student with the practice of pharmacy in general and with the terminology peculiar to pharmacy and the allied medical sciences.

History of Pharmacy

There was no general agreement by the group on when this course should enter the curriculum. A few thought that it could be a first year course. The majority, however, thought that it should follow the orientation course in order that the student might better comprehend the pharmaceutical terminology essential in teaching the course.

Professional Communications
Ethical and Professional Relations

Both of these topics can be integrated with the various pharmacy courses, particularly, Pharmaceutical Jurisprudence and Dispensing Pharmacy. Many of the methods utilized are described in later papers, such as, the telephoning of prescriptions to the students in Dispensing. Most of the members present thought that these two topics are best taught when the particular situation arises in the classroom. In other words, the student should have some particular problem with which to associate the idea.

PHARMACEUTICAL CALCULATIONS

JOSEPH B. SPROWLS
Temple University

The title "Pharmaceutical Calculations" has been used for this discussion rather than the more common "Pharmaceutical Arithmetic" or "Pharmaceutical Mathematics" because this is the title utilized by the Committee on Curriculum for the academic discipline which is to be considered. Because the recommendations of the Committee on Curriculum, as presented in the book *The Pharmaceutical Curriculum,* are quite brief, they will be reproduced here in their entirety.

> "Pharmaceutical calculations. – The course in pharmaceutical calculations consists of a study of the application of the systems of weights and measures and the mathematical calculations involved in pharmaceutical procedures and practice.
>
> "The objective of the course is to develop ability to solve the mathematical problems encountered in the preparation of pharmaceuticals and the compounding of prescriptions.
>
> "The suggested content of the course includes: (1) weights and measures; (2) percentage and percentage solutions; (3) alligation; (4) concentration and dilution; (5) calculations of doses; (6) alcoholometric calculations.
>
> "This course should precede the course in pharmaceutical preparations but it should not be further removed from the latter than is necessary. The second year of the professional curriculum appears to be the most appropriate place for it.
>
> *"It is suggested that a total of 32 clock hours will be required for the course, which should carry 2 semester hours of credit."*

While this is a very concise and straightforward statement, the various colleges of pharmacy have evidently found the implementation somewhat more difficult. Probably no course in the pharmaceutical curriculum has been more variously treated than has the subject of pharmaceutical calculations. Examination of the bulletins will reveal that it is offered (in one college or another) in every conceivable location in the syllabus from the first semester of the Freshman year to the last semester of the Senior year. In at least one college no separate course in pharmaceutical calculations is offered, while in other colleges the course is repeated at least once during the four years. The amount of credit given for the course varies widely.

Probably no single reason can be given for this extreme variation in the course, but one suspects that a very important reason is lack of agreement on the purpose which the course is expected to serve. One usually regards mathematics courses as "tool" courses – courses which are expected to teach certain routines or manipulations which may be utilized in developing other fields of knowledge or in extending other more practical applications. The position most commonly occupied by the course in pharmaceutical calculations would seem to indicate that this is its intent – that it shall be used as a tool in the development of other courses in pharmacy. Unfortunately, however, it has often become a course designed to teach certain factual information. Consider, for example, the suggestion of the Committee on Curriculum that the courses should include "mathematical problems encountered in the preparation of . . . the compounding of prescriptions". This might be regarded in football parlance, as "outrunning ones interference".

It is difficult for this writer to understand why the problems of dispensing pharmacy must be taught as early as the second year, which is far in advance of the teaching of the techniques involved, and it is his opinion that this leads to much inefficiency in teaching. For example, let us consider a typical dispensing problem which might be presented to a sophomore student under such circumstances:

> "A pharmacist used five tablet triturates each containing gr. 1/100 of a drug in the preparation of a prescription calling for 24 powders. What dose of the drug is contained in each powder?"

To the instructor this seems a perfectly straightforward problem, because he has an understanding of the procedure involved. He knows that the tablet triturates will be reduced to a powder by trituration, that other drugs or a diluent will be added, and that the total bulk will be divided into 24 folded powders. But consider the plight of the student. In all probability he has not yet been introduced to tablet triturates. He may or may not have studied trituration, and in most instances he would not have encountered powders, because these are not usually covered before the course in dispensing pharmacy. Before the student can really understand the problem, then, he must be given some understanding of the procedures involved. This is commonly done either by giving a demonstration or by a lecture explanation. –But what an inefficient procedure! Is it not better to leave such problems as these until they can be taught as a part

of the course in dispensing? Surely the problem can be more thoroughly understood after the student has studied the dispensing procedure involved. In all of this we must bear in mind that many students now enter the colleges of pharmacy with no previous experience in pharmacy. In fact, some students complete the entire curriculum without accomplishing any concurrent practical experience. This is regarded as important, because in all probability a student's apprenticeship experience helps a great deal in giving him an understanding of the types of problem just mentioned when they are presented out of the normal sequence. In the future we will not be able to count upon this practical experience and must develop a proper understanding of the problem before the problem is presented. This would seem to be the ideal teaching method in any case.

In short, then, it is this writers' opinion that teachers of pharmaceutical calculations have often erred by presenting problems before a proper understanding of the terminology has been developed in the student's mind. Very often he has found that a student who seemed to be lacking in mathematical ability was really lacking in understanding of the problem as presented. Once the problem has been reworded in simpler terms or once a complete explanation of the procedure involved has been revealed, the student suddenly "sees the light" and solves the problem with no difficulty.

Finally, it is believed that the teaching of pharmaceutical calculations should not be confined to a single course of two semester hours, but should be included in almost every professional course in the curriculum. For example, let us consider the matter of isotonic solutions. Some teachers include this in the course in pharmaceutical calculations, but we might properly question whether it belongs there. The subject of osmotic pressure is undoubtedly covered from a theoretical consideration in the course of College Physics. Usually calculations regarding osmotic pressure are covered at this point. The question of physiologically isotonic solutions is then covered in courses of physical pharmacy or dispensing pharmacy. At this point the problems involved can be related to theoretical considerations. If, on the other hand, the subject is first considered in the course in pharmaceutical calculations, the whole theory of osmotic pressure must be presented even though it will be later developed as a part of other more fundamental courses. Similarly, specific gravity is usually covered in the standard course in physics and problem exercises are given. To spend a great deal of time on this subject in pharmaceutical calculations would seem to be unnecessary duplication. (In the event that a course of physics is not included in the syllabus of a school, these latter comments may not apply.)

To summarize, then, it would seem that the course in pharmaceutical calculations should be designed as a tool course wherein the student is familarized with the use of the pharmaceutical tables of weights and measures and the methods of conversion from one to the other. He should also be introduced to such special arithmetic procedures as will not be developed elsewhere in the course (such as alligation, alcoholometric calculations, etc.), and he should be given practice in such arithmetic procedures as will be later developed in such courses as pharmaceutical preparations and dispensing pharmacy.

Many more subjects could be discussed with respect to methods of teaching the various phases of the course in pharmaceutical calculations; however, these will be left for the open discussion which will follow the presentation of this paper.

DISCUSSION LEADER – J. P. Sprowls

Q: When should the course in pharmaceutical arithmetic be taught?

A: If taught as a separate course, it should appear early in the pharmacy curriculum. The more advanced calculations could be brought out in the advanced courses. Several individuals thought that pharmaceutical calculations should be integrated into the entire pharmacy sequence.

Q: How can visual aids be utilized in teaching pharmaceutical arithmetic?

A: One of the best visual aids is the blackboard. Otherwise the use of visual aids does not enter very much into the teaching of this course. One suggestion proposed was the projecting of prescriptions containing calculation problems and working on that basis.

Q: What other teaching aids can be used?

A: It was proposed that problems could be devised around the use of different scientific instruments, such as, the Mohr-Westphal balance. The student would be required to use the instrument and make the necessary calculations.

Q: Should the method of teaching this course be dogmatic?

A: The student should be offered all the methods of solving a problem and allowed to choose the method which is easiest for him.

TUESDAY DISCUSSION LEADER – L. Busse

It is a real pleasure for me to act as your discussion leader this afternoon. I assure you, though, that it was with humility and a great deal of concern that I accepted this request on the part of Chairman Zopf. My experience with this type of leadership is practically nil and I find myself wishing that I was another George Webster right at this moment, a person who does this type of thing very admirably.

I gathered from the proposed program for this day and certainly from the words of Chairman Zopf that in our discussion periods we are to place considerable emphasis on "How to Teach" and much less emphasis on "What to Teach". However, from an analysis of topics discussed these mornings, it doesn't seem to me that we can divorce the "What" from the "How" entirely. We might be facetious and say we ought to discuss "How to Teach What".

In our two morning sessions to date we've heard papers giving us excellent material for discussion this afternoon. It is everyone's hope, I'm sure, that we can have a lively discussion and that from this discussion can come ways and means to apply this material to our own particular situations. It is my hope that we can limit today's discussion to the subject of the learning process and the methods by which it can increase the achievements of our pharmacy students. As I lis-

tened to the speakers these past mornings, my conscience began to bother me somewhat as I recalled the lack of serious preparation of some of my lecture material because of the press of other important duties. Having analysed these many factors affecting the learning process I'm sure you too will have to ask yourself, "Have I done all that I could to help my students learn and thereby increase their achievements?"

I gathered from the speakers this morning that procedures in learning involve the following: reception, registration, retention, recall and recognition. As these words were being spoken, I immediately made a self-analysis and asked myself the following: "Have I sent forth enough stimuli in my lectures in order that students could receive them?"; "Was reception possible?"; "If so. were the stimuli strong enough to make them register?"; "Were they, as Dr. Pella stated, "Listening and not hearing"?"; "Were they looking but not seeing?"; "Did I make it interesting enough in order for him to desire to retain it?"; "If so, did I give him enough associated experience in order for him to recall?". To recollect, an idea must be attached to other ideas by association. I asked myself, "Did I set up all the cues for him to have this myriad of interconnections which they spoke about and which would enable him to recall?"; "If so, did I make the description of the picture clear enough for the student to recognize it in other situations?"; "Had I given them such a rich background of meaning and experience that the image I created would be familiar in the many different settings or situations he will find it?"

I hope that as you ask yourselves these questions and any procedures that you have used to aid the student in his learning process come to mind, you will give all of us the benefit of your wisdom in this regard.

I also became aware this morning that learning is not necessarily the natural thing for most students to acquire. As I look back on my past experiences with students and, particularly, since I have become involved with academic deficiency cases, I can see more clearly now what the speakers were trying to tell me, namely, that the student must see some need for learning. That this need must be a personal thing and that the learner must associate the possible result with his own life and goals. I see many of our problems in pharmaceutical education now as being based upon a lack of these understandings on the part of the student. We might ask ourselves the same questions that might come into the mind of the pharmacy student when he labors in the quantitative analysis lab or when he sweats over advanced mathematics or when he slaves in the dispensing laboratory compounding vicious and dastardly mixtures or when he reads and is aware of the fact that 90% of the prescriptions in a drug store are not compounded. We all see and I hope understand the need for these studies in our curriculum, but I must ask myself as well as all of you, "Is the student in your class and my class as aware of the need for this background material and as convinced of it as you are?" If he isn't, he is not going to learn. Second, "Is he fully aware of this need as a personal need?" Again, if not, he will not go far in the learning process as retention and recall. I also gathered from this morning's speakers that we could probably sum up the teachers' responsibility in the learning procedure as motivation. As Dr. Pella, Dean Durell, and Dean Bramell stated, "As teachers we must either remove or in some way reduce the barriers which are inherent as a result of the artificiality of the situation". I think we must also realize that certain pharmaceutical education would come under this heading very nicely as far as being artificial in relationship to much of the practice of pharmacy as it exists.

The problem of how to help students to see the worthwhileness of learning or how to develop this conscious need of learning is paramount in teaching. Again, those of you who have had experience with this problem of motivation and have any unique procedures or methods which you use to motivate a student to learn, will I hope, give all of us the benefit of your knowledge and skill in this regard.

It seems to me, then, that in our discussion this afternoon we should evaluate the course in pharmaceutical preparations in the light of the things I have just mentioned. It also seems to me, therefore, that if these are the essential things in the learning process, one of the first and most important requirements of any course should be that it have specific objectives. Throughout our general sessions we have also been considering and discussing the values of course objectives in a general sense. This afternoon I should like to suggest that we initiate our discussion by first considering these general questions on the subject of objectives. A number of these have been answered in the affirmative by our speakers in the morning session. I don't see the value of spending a great deal of time discussing them now, but I think we ought to go over them to establish our agreement as to the objectives. And so, to initiate some discussion in this first part, I jotted down these questions. If we agree objectives are necessary for specific courses, then, I should like to throw out the question for discussion, "How does one determine, state, and use the objectives for a course in pharmacy?"

OBJECTIVES FOR PHARMACEUTICAL PREPARATIONS AND TECHNOLOGY COURSES

I. *Pharmaceutical Preparations*

The course in pharmaceutical preparations is intended to familiarize the student with the classification, principles, and processes of pharmaceutical preparations.

Objectives:

A. Understanding of the principles and processes of preparing pharmaceuticals and familiarity with the various classes of pharmaceuticals as such and as they are distinguished from one another;

B. Mastery of the essential skills used in preparing standard pharmaceuticals;

C. Understanding of the preservation and storage of specific types of pharmaceuticals;

D. Information with regard to the general therapeutic usefulness and the dosage of the various pharmaceuticals.

The Student Will Obtain The Following Informa-

tion:

Definition (class definition); History; Methods of preparation and the chemical-physical principles involved; General properties (physical, chemical, pharmaceutical); uses (medicinal and pharmaceutical); and storage and preservation.

II. *Pharmaceutical Technology*

The course in pharmaceutical technology should immediately precede the one in dispensing pharmacy. It employs as a foundation the principles of pharmacy learned in the course in pharmaceutical preparations and those acquired in the course in physical pharmacy.

Objectives:

A. Increased familiarity with, and integration of, scientific knowledge and the skills acquired in previous basic science and pharmacy courses;
B. Comprehension of other scientific principles applicable to the production of pharmaceuticals;
C. Increased facility in the techniques used in producing more effective medicinal products;
D. Appreciation for, and realization of the importance of, pharmaceutical elegance in preparations and prescriptions, together with familiarity with the agents and methods to attain this result;
E. Ingenuity and creative thinking in the application of the basic knowledge and pharmaceutical skills to (a) the compounding of prescriptions, (b) product formulation for retail or hospital level manufacturing, and (c) the advising of physicians on the formulation of extemporaneous prescriptions; and
F. Appreciation for, and realization of the need for, a high degree of pharmaceutical skill and a high level of professional competence in pharmaceutical practice.

DISCUSSION LEADER: L. Busse

Discussion Theme: How does one determine, state and use these objectives as outlined for a course in pharmaceutical preparations?

Q: Should the outline of course objectives be an individual or a group effort?

A: It was generally agreed that a group effort produced the best results. Two procedures for arriving at the end result were presented. The first method suggested that the individual course instructor should outline his course objectives on the basis of the objectives previously outlined by the group. His course objectives would then be submitted to the group for criticism and changes. The second method suggested that the course outline should begin as an individual effort of the course instructor and subsequently be submitted to the group for criticism and correlation with the preceding and succeeding pharmacy courses.

Q: Should students be supplied with a list of the course objectives?

A: Yes. The value of this action was not determined but the opinion was expressed that it might help the student to understand what he could be expected to gain from the course.

Q: If we agree that course outlines should be used as a method of gaining our course objectives, should these course outlines be an individual or a group effort and should they be made available to the student?

A: Course outlines are a valuable aid in attaining course objectives. No opinion was expressed as to whether the course outline should be an individual or group effort but the indication was that in general practice it is an individual effort based on the objectives set forth by the group. Making the course outline available to the student was considered desirable in that it stimulated the students interest in the course and led to advanced reading with the final results being increased motivation. It was also stated that course outlines in the hands of the student kept the instructor from straying too far from the course objectives.

Q: How does one determine how much time to allot to each part of his course?

A: It was suggested that a survey of the various types of prescriptions compounded in that particular area would indicate the relative importance of each type of preparation and that the course could be outlined on the basis of the results of this survey. The majority, however, objected to this approach and suggested that the amount of time allotted to each type of preparation should be determined by the time required to fully cover the basic principles of each type. Their feeling was that a student should be thoroughly trained in the techniques of compounding all types of preparations regardless of how often he might encounter them in actual practice. The outline of the work to be accomplished in the laboratory was also considered important in governing the amount of time allotted to each type of preparation in the lecture.

Q: How can we organize and present the material available in a way to achieve these objectives in a course in pharmaceutical preparations?

A: Several proposals were presented and are given as follows:

1. Organize the material according to the system in common use by classifying all the preparations as to their type. This method would allow the student to become thoroughly acquainted with each type of preparation and would allow him to become proficient in the techniques of preparing each type based on the fact that he would prepare several of the same type of preparation in a laboratory period.
2. Material should be organized along the lines of homogenous and heterogenous preparations. This method would place the emphasis on the physical principles involved and the techniques of preparation.
3. The material should be organized in correlation with the study of the physical and chemical properties of the drug involved. This method would place less emphasis on the techniques involved and would be directed toward teaching the students the therapeutics and chemistry of the preparation. The student

would, however, make several of each type of preparation throughout the course, but would not be restricted to one type of preparation during a laboratory period. It was the opinion of this group that if the student had no knowledge of the physical and chemical properties of a compound, the techniques applied in the lab became mere mechanics and that the student would not be as able to correlate specific drugs with the various types of preparations.

Q: How does one know after making a change in a course that the change has been successful? How do you know when you have finally reached perfection in the manner in which the course should be presented?

A: A change in a course could be considered successful if it results in increased motivation of the student. It was admitted that the success of a change cannot be measured with any reliability and that it would be necessary to rely principally upon your own personal observations. Constant changes in industrial and retail practices will require that the colleges of pharmacy maintain a flexible program to keep up with these changes, therefore, one will never attain perfection but must keep constantly alert to the changes of the times.

WEDNESDAY DISCUSSION

Q: What techniques can be employed in a lecture by an instructor to demonstrate the physical and chemical properties of the drugs to be encountered by the students in the laboratory?

A: A display of the actual drugs to be used has been found useful. It was also stated that drugs should be displayed in various states of deterioration and degradation in order to acquaint the students with good and bad products. Displays of finished products, such as, elixirs, ointments, etc., were considered useful. Simple experiments, such as, the salting out of volatile oils, can be easily demonstrated in the lecture as an aid to teaching physical and chemical properties of the drugs.

Q: Should we use lecture demonstrations?

A: The main objection to the use of lecture demonstrations was that the classes and classrooms are usually too large for all the students to get a good view of the demonstration. It was argued that usually the student saw only the outside of the demonstration vessel and was generally not able to correlate the techniques demonstrated with what was occurring inside the vessel. It was suggested that this could be overcome by the use of an overhead mirror through which the student could observe all phases of the operation. Another suggestion was to accompany the demonstration with colored lantern slides which would show the student what the product should look like at each particular stage of the preparation. The use of movie film was considered a valuable aid in demonstrating techniques in lecture but the general opinion was that it should be accompanied with an accurate explanation of all procedures. For the purpose of demonstrations it was suggested that classes should be broken down into small groups whenever possible in order to allow as many students as possible to observe the procedures from a close range and to ask questions about any phase of the procedure that is not understood.

Q: Should demonstrations be used in the laboratory?

A: Yes. The group considered demonstrations prior to laboratory work absolutely essential.

Q: What other procedures can be used in the laboratory to motivate the student?

A: Analysis of the student's finished preparation was considered an excellent aid to motivation. Although this practice occupies a lot of the instructor's and assistant's time it was felt that at least a small number of the preparations should be assayed each year. The laboratory could be designed to include certain preparations which would easily lend themselves to spectrophotometric analysis and colorimetry. The idea was proposed that a series of experiments could be set up as part of the laboratory work by which the student would be able to observe some of the physical and chemical properties of the products with which he was working. For example, he could take a few cc. of an aromatic water he has prepared and add a few grams of NaBr to observe the salting out effect. It was also suggested that use of the products prepared in future courses and in other departments of the University would develop a sense of responsibility in the student and tend to lead him toward doing the best possible job.

Discussion of Physical Pharmacy

Dr. Zopf: Physical Pharmacy may be defined as the application of physical and chemical principles and laws to a study of pharmaceutical systems. It is meant to embrace the study of the application of physical and chemical principles or laws to the preparation of modes of administration, and to serve as an aid to better understand the manner by which the mode of administration influences the rate or degree of activity of the drug.

The objectives of the course as outlined by the Curriculum Committee five years ago are as follows:

a. To increase the understanding of the physical and chemical laws as they apply to the pharmaceutical systems.
b. To develop the ability to analyze, and interpret qualitatively the physical-chemical aspects of pharmaceutical systems.
c. To develop the ability to apply these principles to the formulation of various modes of administration.
d. To increase the familiarity of the student with the instruments used in the physical-chemical studies of pharmaceutical systems.

It was recommended that the basis for this course should be the following subjects: calculus, quantitative analysis, organic chemistry, physics, physical chemistry and pharmaceutical preparations. The above prerequisite courses were outlined on the basis of the 6-year program.

A poll conducted of the attending schools showed that, at present, 5 schools are teaching a course so described by the above definition. The remaining 39 schools, with 2 exceptions, have no formalized course in physical pharmacy. The two exceptions will teach the course for the first time next year. The feeling was expressed by a number of the schools which do not teach physical pharmacy that much of the information outlined for the course was integrated in other pharmacy and chemistry courses. A few individuals stated that they did not believe that the objective of this course could be integrated with other courses and that they doubted that the course could be offered properly on the current 4-year program since it would generally have to be offered without the benefit of the calculus prerequisite.

Q: Is a high-caliber course in physical pharmacy which requires calculus and physical chemistry as a prerequisite essential for the student who has as his objective retail pharmacy?

A: Zopf stated that it was his opinion that if the curriculum committee of a school felt that the course was important enough to warrant their teaching it, then it should be essential for the student primarily interested in retail pharmacy.

Q: How many of the schools teaching the course of physical pharmacy have an accompanying laboratory?

A: Three.

Q: How can physical pharmacy be integrated into other courses in the pharmacy curriculum?

A: The speakers stated that in almost every course in pharmacy there were occasions when phases of this course could be introduced. However, it was felt that it was necessary for the instructor in these courses to have a good background in physical chemistry. There were several dissenting opinions which expressed the feeling that the course could not be integrated with other courses properly. Others felt that the course could not be offered properly to students without the physical chemistry prerequisite.

THURSDAY DISCUSSION LEADER – D. C. Brodie

I know that after three days of these three hour afternoon sessions you are beginning to get a bit weary and that is certainly understandable, but I hope that you can bear with us for one more session, similar to the ones that we have had during the past three days, and I hope that we will be able to maintain the interest and enthusiasm that we have had on the preceding days. I should like to echo the sentiments of our chairman regarding the stimulation which I hope each of you has received during the week thus far. I have heard so many things myself that actually I feel quite humble in appearing before you this afternoon and attempting to lead your discussion on dispensing pharmacy and I hope that each of you will go back to your own institution with new ideas, with new enthusiasm and that you will find that our being together here this week has been beneficial to you. I am humble for another reason here this afternoon, too. I didn't know it until after the second day's program, but you people have been addressed by Deans and Associate Deans all week long including our Chairman here. I'm the only layman on the panel, and so, us commoners are going to have to stick together today and see if we can't hold our own against them. You see, my neck is way out because if we go down on this it is Brodie who led the way.

Now the introduction is Brodie's. The Chairman gave me twenty minutes for this introduction and I will probably use it. Then we will go into our discussion and the first part of it is going to deal with the course in dispensing pharmacy. Not particularly how we will teach but there are certain philosophical aspects on which I should like to get some thinking from you. I am going to touch on two or three things in my formal remarks which I hope may act as a stimulus for a mutually beneficial discussion.

Since a course in dispensing is built around the prescription I have purposely taken it as a separate entity so that we can discuss certain aspects of it including the methods by which it may be most effectively presented, how we assign prescriptions, the number of prescriptions, the use of the telephone and one thing and another.

And then we come down, of course, to the theme of our being here together this week, "How we Teach", and we are going into such things as how we teach incompatabilities, how we teach laws in dispensing, if we do, how to get into pharmacology and all those things, how we teach health supplies, if we do, in dispensing, how we price a prescription, how we evaluate professional competence and so forth. And then I have categorized the last into a miscellaneous group because there is no other place to put them. This, in my estimation, is a part of how we teach, how we stimulate the good student, how we counsel and handle the misfit, and how we develop our own teaching ability. Now, with that general outline of the plan which I should like to follow this afternoon I want to go into my prepared remarks.

SOME OBSERVATIONS ON THE TEACHING OF DISPENSING PHARMACY

DONALD C. BRODIE

Professor of Pharmacy
University of California

This week we are particularly indebted to those, who a few years ago during the course of the Pharmacy Survey, proposed the idea that an annual seminar for teachers in colleges of pharmacy would provide varying degrees of enrichment to pharmaceutical education. Many of you here this week have been reminiscing as I have, recalling that first teachers' seminar at the University of Wisconsin. I dare say that none of you ever get to complaining too vehemently about the overabundance of solar energy provided by an omnipotent heavenly Father without recalling that two-weeks seige at Camp Randall Stadium in 1949. And you will note, my fellow teachers of pharmacy, that our labors were *not* in vain, because since that time teachers' seminars have been limited to one week. I'm sure that we have a certain feeling of pride

in what we did during those two weeks and what accomplishments have been made since that time. Of equal satisfaction to us, is the fact that we are meeting again, in what appears to be the completion of a cycle that we initiated six years ago. We are happy to be here 'mid the historic surroundings and in the serene beauty of New England and to share the hospitality of our friends at the University of Connecticut.

This afternoon we are here to discuss Dispensing Pharmacy. I searched through the correspondence which came to me from our distinguished chairman from the State University of Iowa hoping that I might find a thought or two around which to develop a few introductory remarks. Each time I came up with two conclusions: first, my remarks were to be "provocative," and second, as a staff, we were charged with "How to Teach." This was to be accomplished in twenty minutes. Since I would have difficulty in being provocative even in seventy times seven twenty-minute periods and since Dr. Pella tried for two weeks, six years ago, to tell us "How to Teach," I was fraught with frustration. I dispatched with protocol, ignored the entreaty of the chairman and proceeded from point zero.

My remarks during the next few minutes will be devoted to six topics: (1) the design of the course and its objectives, (2) methods of instruction, (3) what the student should learn, (4) audio-visual techniques, (5) interprofessional problems, and (6) ethics and moral issues. Time will not permit me to develop each of these topics as I might like to do or to a necessarily logical completion. My main objective is to set the stage for the discussion. Wherever possible, I shall express my views on "how to teach."

Design of Course and its Objectives: In the classical 4-year curriculum dispensing occupied the position of a climax and terminal professional course. In the 2-4 program recommended in the Pharmaceutical Curriculum (1), dispensing continues to appear in the fourth professional year. I believe that the old program climaxes around dispensing in a meaningful sort of a way, but in the new program the course becomes less of a climax at that point. In the latter program the climax seems to appear during the third and fourth professional years embracing the areas of physical pharmacy and dispensing. I should like you to give some thought to the proposal that dispensing pharmacy in the 2-4 program might be effectively placed in the third professional year, necessitating the placement of the physical pharmacy area in the fourth year. Slide I.

TABLE I

SLIDE I

SEQUENCE OF COURSES

PHARM. CURRIC.		*ALTERNATE*
Orientation	1st Year	Orientation & Calculations
Calculations & Preparations	2nd Year	Preparations & Technology
Physical Pharmacy & Technology	3rd Year	Dispensing
Dispensing	4th Year	Physical Pharmacy & Technology

There are at least two arguments that to me support this consideration. *First,* the student achieves the psychological satisfaction of filling prescriptions earlier in the curriculum. *Second,* the student gains experience in handling and combining pharmaceuticals that will make problems that arise later in the physical pharmacy area more meaningful.

As to the objectives for the course in dispensing, I am going to submit those that are presented in the Pharmaceutical Curriculum (1). The student should acquire:

1. an ability to understand and interpret prescriptions;
2. skill in compounding prescriptions;
3. an ability to evaluate and correct prescriptions from a pharmaceutical point of view;
4. an appreciation of the legal aspects of prescription practice;
5. an ability to price prescriptions by approved methods;
6. an ability to package and label the product properly;
7. an ability to evaluate prescription specialties in relation to official products;
8. an increased familiarity with medical terminology;
9. an appreciation of the value of the literature of pharmacy and that of the allied professions;
10. an increased understanding of the intelligent use of drugs and ability to advise on the formuation of medication;
11. a professional attitude and a sense of professional responsibility in interprofessional and public relations.

We have been thinking in terms of 8 to 10 semester units for the course in dispensing for a number of years. If you will refer to the Pharmaceutical Syllabus and examine the recommended course outlines, you will find a striking similarity between the outlines for dispensing pharmacy recommended some years ago and that which is generally used today. This is not exactly surprising. However, the pharmacy that is practiced today is significantly different than that practiced 25 years or so ago. It seems to me that the course that we teach today should reflect the changes in practice when we make these comparisons. During the summer I have taken every opportunity when talking with pharmacists of my generation or before to ask for an opinion of the percentage of compounded prescriptions that we used to fill in the "good old days." One group of men about my own age was quite unanimous in thinking that we used to compound about 50 per cent of our prescriptions while another age group suggested that it would have been as high as 80 per cent. Today, of course, we are compounding only about 10 per cent. When determining the amount of time that should be devoted to the course in dispensing this factor should be considered. It relates to the number and types of prescriptions that are assigned, as well as to the amount of time devoted to portions of the subject, such as incompatabilities. Furthermore, it may be significant in determining how best to teach certain materials. I submit to you this afternoon that dispensing pharmacy can be taught to meet the needs of contemporary practice in a time

equivalent to 6 semester units of credit, apportioned in six clock hours of laboratory per week for the first semester and perhaps only three clock hours the second. The time devoted to lecture would be one hour per week the first semester and one or two hours the second. Since I feel that you will perhaps wish to comment on this suggestion, I am not going to elaborate on it further. Suffice it to say that I am speaking of dispensing in the classical sense. The data in Table II are based on figures obtained from the Pharmaceutical Syllabus and from the Pharmaceutical Curriculum (1). Slide II.

TABLE II

SLIDE II

PHARMACY INSTRUCTION IN PHARMACY SYLLABUS
and
PHARMACEUTICAL CURRICULUM
(Clock Hours)

	Total	*Dispensing*	*% Total*
1913 First Edition	245	50	20
1913 Second Edition	315	60	19
1925 Third Edition	750	200	27
1932 Fourth Edition	704	192	27
1945 Fifth Edition	752	192	26
1948 PHARMACY CURRICULUM	844	256	30

Methods of Instruction: The lecture, laboratory and group conference methods of instruction may be used in teaching dispensing pharmacy. After a number of years I have concluded that I tend to prolong unduly the preliminary lectures of the first semester dealing solely with the prescription. When you consider that students are concluding a minimum of 4 years of collegiate experience, a portion of which has been devoted to subjects that are, we admit, quite challenging, some of our lectures on the prescription and related material must be a trifle dull to many students. This is particularly true of students who have had some pharmacy experience. I do not wish to minimize the importance of these basic professional materials, but I believe that it can be taught as, or more, effectively than we have traditionally done. I have found that by writing my own syllabus on Prescription Writing and Related Material that I place in the students' hands the basic material, particularly those aspects that deal with pharmacy practice in California. I lecture directly from the syllabus and assign sizable portions for home study. In conjunction with the syllabus I use a required text and a reference text from which I make assignments. One aspect of these first weeks of the lecture portion of the course that impresses me is the interest that students have in problems that arise in the pharmacist-patient and pharmacist-clinician relationships. I often deliberately direct my lectures toward a personal experience that I can relate to students. This invariably leads students to ask me how I would have handled an experience that they had had with a patient or with a physician. As you can see, I am a proponent of varying degrees of informality in my lectures, particularly with those dealing with some of the basic professional matters. Dr. Pella told us at Madison that the 3 R's of learning are repetition, repetition and repetition, providing, of course, that it is purposeful. The prescription will be the center of activity in the entire dispensing course. Let's not forget that the student will have many opportunities to pick up some of the fundamentals that he may miss during the first few lectures. Hence, I believe that the tempo of the first few weeks of lecture can move quite rapidly without interfering with basic educational objectives. I have found myself devoting about half of the lectures of a 4-unit first semester program to the prescription and its ramifications, including the legal aspects. These approximately 16 lectures I believe can be reduced to perhaps 10 lectures by some imaginative teaching and through the incorporation of suitable teaching methods and aids. I hope that someone will care to challenge this point for the discussion.

I am a strong believer that the use of group conferences has good application in dispensing. Students who are otherwise lost among their contemporaries can be drawn out and brought into discussions. Particularly is the conference method of instruction useful in the laboratory. Prescriptions for proprietary drugs can be made particularly real when discussed in small groups from projected slides. In the new facilities at the University of California we have provided a twenty-student capacity conference room adjoining a forty-student capacity dispensing laboratory for the express purpose of using the conference method of instruction.

Some of you who are teaching dispensing have small teaching laboratories which permit sections in which you can provide one instructor for ten students. I think that such a student-teacher ratio is highly desirable, but in many colleges this feature cannot be attained. During the discussion I should like to have someone comment on his experiences with teaching assistants in the dispensing laboratory and how much responsibility they should carry.

In 1949 Dr. Pella gave us an idea that I followed to a partial completion. I refer to the use of stated desired student attainments in teaching. For the first semester of our course in dispensing, my colleague, Dr. Sidney Riegelman, and I set down every technique every experience and every achievement that we wanted our students to gain during the time we had them in that class. That set of desired student attainments has become a yardstick, and whenever we have had any question regarding our instruction we immediately refer to our list. I am such a strong believer in this device for teaching, particularly in laboratory instruction, that if I were a dean I should require every member of my staff to prepare statements of the desired student attainments.

What the Student Should Learn: I could not possibly discuss this subject in the time we have. Actually our objectives are a fair indication. However, I shall enumerate in broad terms a number of accomplishments that we should achieve. (1) The student should understand the prescription in its entirety; his responsibilities in filling it, and the technical skills involved in its preparation and dispensing. (2) The student should be able to evaluate the prescription in terms of its legal implications and its pharmacologic, therapeutic and toxicologic properties. (3) The stu-

dent should be familiar with the sources of supply of the materials that he uses, whether they be natural or synthetic in origin, or whether they be proprietary or nonproprietary in nature. (4) The student should have confidence in his abilities as a prescription pharmacist and the course in dispensing should provide sufficient experience that he can develop both professional competence and confidence.

Audio-Visual Techniques: After our general session on audio-visual methods, I'm sure that anything I might add will be an anticlimax. You recognize that in dispensing pharmacy we are dealing with a purely applied and professional area. Applied areas of instruction usually abound with opportunities for the use of teaching aids. Films slides, charts, drawings, displays and recorders can all be brought into the instruction in dispensing, making it more real, more dynamic, and more effective. The Committee of the American Association of Colleges of Pharmacy on Audio-Visual Education selected the field of Pharmacy Techniques as the area of competition for the first Award in Audio-Visual Education, not only because of the lack of good materials in this area, but because of the opportunities that it presents for creative work.

Interprofessional Problems: I am sure that all of you use guest speakers from the other health professions in your instruction in dispensing. One problem that has always confronted me has been the inability of the speaker, regardless of my care in briefing him beforehand on our needs, to do a job. He may not be able to speak "our language"; he may talk at a lay level where actually our students are able to accept a much higher level of presentation; he may be a "back slapper" and devote his time to political rather than professional emphasis. In fact, these experiences often discourage us from inviting our friends from dentistry and medicine to help us with specialized areas of dispensing. I tried a new technique this spring that I want to pass on to you because it gave me a new approach to this problem. Each year we devote about three lectures on dental-pharmacy problems and I invite two members of the staff of the College of Dentistry to assist me. The first lecture is entitled "The Current Status of the Dental Caries Problem." The second lecture is designed to provide a quick orientation in dentistry for pharmacy students in which two objectives are sought: (1) terminology, and (2) a briefing of those areas of dental practice that in particular require medication. I usually give the last lecture and attempt to summarize the drugs of general dental application, special points of interest, and inter-professional problems. Rather than having formal presentations for the second and third lectures, this year I combined with a dental colleague and we presented a symposium before the class. I served as moderator, introduced each subject we discussed, and in general directed the discussion in a manner that I felt met the needs of the pharmacist. We had met before the meeting and prearranged our general sequence based on the question and answer technique. We accomplished several things which have been difficult to do in previous experiences. *First*, I was able to control the direction of our discussions; *second*, the pressure was removed from my colleague and his contributions were significantly greater when compared with those resulting from his formal lectures, and *third*, student interest was markedly improved.

Ethics and Moral Issues: Students seem to have a sincere interest in evaluating the moral issues of pharmacy practice. What they see in pharmacy is not always consistent with their own sense of values nor with those that we in the colleges endorse. I am introducing this into our discussion this afternoon because of a recent experience that I am going to relate to our students this fall. Mrs. Brodie and I were visiting a former student and his family in northern California last month and during the course of the weekend my friend took me to the pharmacy in which he is employed. He revealed to me practices that were going on in that establishment that fall under what we call "substitution." The proprietor of the pharmacy was dispensing drugs that were purchased solely with the intent of using them in prescriptions that were specifically written for brand-name items. He opened filing cabinets and closed lockers where these items were stored, all of them available for use, yet out of sight to a casual observer. He pointed out the exact likeness of the substitute for the brand-name item and the large discrepancies in price. The proprietor was charging patients for the brand-name items, but dispensing the substitute. My friend permitted me to prepare samples of the genuine and the spurious products which I will exhibit to students. I have the samples here and you are welcome to examine them. I believe that this one instance properly presented, can clarify for students once and for all just what the "substitution" problem is and make it possible for them to see the position of the pharmacist as well as that of the opportunist manufacturer.

As I conclude my introduction to this afternoon's discussion, I am mindful that there are a number of interesting topics that I have not mentioned. You will wonder why very little has been said about incompatibilities, proprietary drugs, pharmacy laws, and the number of prescriptions that a student should fill. I can assure you that each of these and others will be before us before we adjourn this afternoon.

DISCUSSION

I want to center the first part of our discussion this afternoon around the course in dispensing. There are several aspects of this that we might discuss. There is one thing that I should like to have someone comment on. I know it varies from institution to institution but just to start this thing off I should like to have someone comment on what their estimation is of the optimum size of a class in laboratory instruction. Now I am going to talk more about laboratory instruction this afternoon than I am about the other methods of instruction because it seems to me that the whole instruction hinges right around the laboratory. I'd like to have someone comment on two aspects of laboratory teaching. One is the optimal size of a laboratory class and the student-teacher ratio in the dispensing laboratory. Now we have some problems peculiar to laboratory instruction in dispensing that we do not have in the other courses. In our own institution we have a very high student-teacher ratio which I am not particularly proud of and I don't think my Dean is and we would like to do something about it. Am I right

when I say that laboratory instruction is expensive, Dean Zopf? (Yes). We saw the other day that the lecture method is the cheapest, probably, that we have. In our own institution we have usually one instructor for every twenty students. Now our friends here at the Univ. of Conn. have one instructor for every six students. Let's take that as a range. Now I'd like to have someone comment if you have some thoughts on the matter on what you think about the size of the class and the student-teacher ratio.

Q: What do you think the student-teacher ratio in a dispensing laboratory should be?

A: A 1:10 student-teacher ratio would be satisfactory but the lower that can go the better.

Q: How large should a dispensing laboratory class be?

A: Keep them as small as possible. Even if the student-teacher ratio was the same in a large class as in a small class there would tend to be much more confusion in the large class.

Q: Of the schools attending, what is the average student-teacher ratio in the dispensing laboratory?

A: A poll of those in attendance showed the mean ratio to be somewhere between 1:10 and 1:15.

Dr. Brodie: Dean Tice, would you care to comment on your own experiences regarding student-teacher ratio?

Dean Tice: Why obviously, the ideal is one teacher to each student. Our present ratio is 1:12, but there is another aspect of this which I don't think we should overlook. In most cases some of the teachers are graduate assistants and unless they are thoroughly briefed in what is desired of them, oft-times there is a wide variation in the quality of instruction given between the man in charge on the one hand and the graduate assistant on the other. Usually with graduate assistants the laboratory assistance which they give is a means to an end. They are not there primarily to teach but to get their own graduate training. They may actually despise the work in the pharmacy laboratory, they may be majoring in some other branch. So unless we guard very closely against this we may find that our student-teacher ratio is very good but because of this other aspect, it is a very poor type of training which is being given. Consequently, in our own institution we make sure that in each laboratory session there are two full-time staff members, in addition to any laboratory assistants who may be in the laboratory. It is also important that if you take graduate assistants from some other school they may have been trained in some laboratory technique which is quite different from the way you are trying to teach. I think it is essential that the teacher in charge have conferences with these graduate assistants and try to explain the methods to be taught. If the method proposed by the graduate assistant is better then it will be adopted. If it is not, then you will come to some agreement and you should teach one uniform method. It is a mistake, I believe, to have two sections of the same senior class, for example, one being taught one method of making a product, the other being taught another. It causes confusion in the minds of the students and I am sure it does not lead to good teaching. In our own department we have staff meetings where a new graduate assistant teaching his first year has exactly the same vote in decisions which are made concerning teaching as I have myself. We come to a democratic decision on how it is to be taught and from that time on it is taught that way.

Dr. Barr: We must also consider the use of graduate assistants as stock boys which would cut down the student-teacher ratio. In our own institution we have full time stock boys to prepare the lab and the graduate assistants spend their full time with the student in the laboratory.

Q: Is it necessary for us to correlate, exactly, our laboratory with our lecture or can they be run, with certain reservations, more or less as separate entities?

A: The general opinion was that correlation of lecture and laboratory in dispensing was not necessary.

Q: How should the prescription be presented to the student in the dispensing laboratory?

A: Several ideas were presented. One of the most prominent was the use of the telephone where the instructor calls the student on the phone, gives the prescription in the same manner that a doctor might and asks pertinent questions such as a physician might ask. Another suggestion was for the student to receive the prescription at a counter from an instructor who is acting the part of the patient. The instructor would place the student under pressure by asking questions and imitating the actions of a patient as he is encountered in the drug store. The use of actual prescriptions was recommended and, where feasible, the use of those that contain errors, such as, over doses and incompatibilities, to keep the student under pressure. Projection of actual prescriptions onto a screen was also considered a valuable aid.

Q: How many prescriptions should a student receive during the course in dispensing?

A: As many as the student can fill correctly. Give them an excess and grade them on the number that they fill correctly.

Q: Should we put the dispensing student under pressure?

A: In general, this is as close as the student comes to the real life situation in school and we should endeavor to make it as realistic as possible. Putting them under pressure adds to the realism and eliminates some of the artificiality of the situation.

Dr. Busse at this point interjected the remark that he felt we should not go too far in putting the student under pressure. He stated we are trying to cover the apprenticeship somewhat in our dispensing laboratory. His feeling was that the proper place for the apprenticeship was in actual practice and that we should not let it overshadow the teaching of theory for which we are responsible in the dispensing course.

Dr. Brodie: We will now hear a report by the com-

mittee headed by Dean Brecht. They are to report on "How We Teach Incompatibilities".

Dean Brecht: The committee agreed that incompatibilities should not come during one specified period of time in dispensing but should be spread throughout the entire laboratory. They felt that giving incompatibilities all at once gave the student the false sense that all prescriptions contained incompatibilities. They agreed that approximately 90% of the incompatibilities were chemical in nature and that the student drew on his previous courses heavily, especially qualitative analysis. The committee also agreed that the chapter or chapters on incompatibilities should be discussed near the end of the year. This gave the instructor an opportunity to bring in special cases which had not been covered in the laboratory and gave the student a chance to review experiences he had already encountered in the laboratory.

There was disagreement as to how the student should receive the incompatibility. Some thought that it should be thoroughly discussed and corrected before the student attempted its preparation. Another idea presented was that the student should be required to fill the incompatibility as is and then try to find out how to correct it, either by himself or with the aid of the instructor.

Q: Does this imply that the incompatibilities of the drugs should be discussed at the time the drug is met in previous courses such as, organic medicinals?

A: I don't think the instructor of a course, such as organic medicinals, should try to anticipate the needs of the dispensing course, but there are certain basic chemical and physical properties which the student will learn in that course that will help him to recognize certain incompatibilities when he encounters them.

Q: Since we consider dispensing a terminal course which brings together the information from all the previous courses and not a course for the introduction of new material, don't you think it would be logical for incompatibilities to be introduced in these previous courses?

A: I don't believe that the dispensing course should be limited to the recalling of previous information. There should be introduction of new material as well as the tying together of old information.

Q: How far can we tell a student to go in changing an incompatibility without informing the physician?

A: No rule of thumb can be given, but one should always be certain that there is no change in therapeutics. Some expressed the opinion that it might be a good idea to consult the physician in every instance, especially if there is any change in therapeutics, color, taste or odor. It was also felt that if a physician persists in writing an incompatibility, he should be informed for his own information. It was stated that the student should be impressed with the knowledge that by changing a prescription, he then assumes full responsibility for that prescription and the physician is not liable for any untoward effect from that prescription.

Dr. Brodie: We will now have a report from Dr. Osborne's committee on Pharmaceutical Law as it applies to dispensing pharmacy.

Dr. Osborne: The committee agreed that certain phases of pharmaceutical law must be taught when they are encountered in dispensing. This is concerned primarily with the laws governing packaging and labelling and the over-the-counter sales of insecticides, poisons and so forth. The committee felt that these laws should be discussed at the time they are encountered in the course rather than setting aside a special number of lectures to cover them. It was felt that the pharmaceutical laws in general should be covered in Jurisprudence.

Q: What governs the use of external labels on prescriptions?

A: Usually there is no law covering this. In the case of ointments the nature of the preparation is such that there is not much chance of it being taken internally. The use of a different label (probably red) with "For External Use" written across the bottom is probably the answer to this problem.

Q: Should we use "Poison" labels on poisonous prescriptions?

A: Most state laws do not require it. One encounters a psychological problem here and should know his patient well if he intends placing a "Poison" label on the prescription.

Dr. Brodie: We will now have a report from Mr. Fenney on "How We Teach Proprietaries".

Mr. Fenney: Three schools were interviewed as to how they taught proprietaries. The first school taught it as a separate course where the student was acquainted with 30-40 proprietaries in a 50 minute lecture. The specialty itself was not shown to the class but at times literature was available to the student. The instructor of the course thought it did a fair job but admitted that the students become somewhat bored with this manner of presentation. The other two schools interviewed taught proprietaries in conjunction with their dispensing course. In both cases the student was required to fill a number of specialty prescriptions in the laboratory and price them. These were taken to the instructor who quizzed the student on the prescription in general. In one school the student was required to spend a limited amount of time in the model pharmacy where he arranged displays, inventoried stock and filled prescriptions. Both schools felt that this method eliminated boredom to the student. They also felt that the student absorbed more information since he was able to handle the product. Both the latter schools also tested the student on his ability to identify unknown proprietary products.

Other ideas presented on this matter were as follows: Some felt that we should not stress proprietaries too much since it is a constantly changing field with several hundred new preparations

coming out every year. This makes it almost impossible for a student to learn a significant number of useful proprietaries. Others thought that the student should be taught to relate new products with those already on the market. They felt that he should be able to identify similarity between products. Others stated that they felt that it was not a good policy to have students quizzed on their ability to identify proprietaries by sight since color, shape and odor are not basic properties and are quite often changed. They felt that it was a bad practice for the student to acquire a sense of false security. Others felt that we should minimize the teaching of proprietaries because that information should be acquired during the students apprenticeship and that we should retain dispensing more as an academic course.

In closing these meetings it was agreed by the attending members that they would like to see these seminars continued in future years. A number of individuals indicated that they would be willing to pay registration fees, if necessary to defray expenses.

Pharmacology Section

AIMS AND OBJECTIVES OF MY COURSE IN PHARMACOLOGY

FRANK T. MAHER
Section of Biochemistry, Mayo Clinic
Rochester, Minnesota

I. *General Objectives*
1. Orientation: The position of pharmacology in the health sciences.
   a. Background.
   b. Texts in pharmacology and in related subjects.
   c. Literature.
2. Integration of pharmacology with areas of study closely related and frequently overlapping.
3. General understanding: The correlation of biologic implications with physico-chemical properties, and with pharmaceutic formulation.
4. The application of pharmacologic action to therapeutic use.
5. The role of drug action in the totality of therapy.
   a. Past development.
   b. Present status.
   c. Needs of therapy.
   d. Developing trends—adaptations in a progressive field.

II. *Particular Objectives*

A. First Quarter: Fundamental and preparatory.
1. Some understanding of the problems posed by the use of drugs in therapy.
   a. Rational vs. empiric treatment – an introduction to the concept of diagnosis and its relation to treatment.
   b. Symptomatic vs. definitive, specific, supportive or maintenance therapy—an introduction to the physiology of symptoms.

Consider, (1) the pharmacist in his liaison role between prescriber and patient may be the first professional person to learn of symptoms as they may be related to the pathology of disease, or to the undesirable effects which may accompany therapy, and (2) as pharmacists we are concerned not with the diagnosis of disease, but rather with the abnormal physiology of disease and its relation to the action exerted by drug agents.

2. Some understanding of basic tissue responses to environmental changes, including the application of drugs.
   a. A brief review of biologic phenomena frequently involved in the mechanism of action of drugs.
   b. An introduction to certain pathologic processes.
      The nature of the inflammatory response
      An orienting concept of degenerative, as distinct from neoplastic, infectious or deficiency states.
3. A concept of what may be accomplished by drug action – limitations as well as potentialities. An approach to this is gained by discussing typical examples applying the above principles to structures and mechanisms involved in the action of type drugs.

B. Second and third quarters: Pharmacodynamics, toxicology, chemotherapy

In our consideration of this subject matter, directed by the department of pharmacology of the college of medicine, we are concerned here with course aims and objectives as they apply to our students in pharmacy, and as they integrate with the objectives of the overall curriculum in pharmacy.

1. Inclusion of an adequate course content. Choice of content is based upon a broad but current concept of the needs of good medical, dental and veterinary practice.
2. Some understanding of the regulations controlling the development and marketing of drug agents. At the University of Illinois, valuable material in this area is contributed by courses in pharmacy, and in jurisprudence.
3. Some understanding of current trends in pharmacologic development.
4. An attempt to establish an outline of desirable information pertinent to the individual drug – an outline helpful in the organization of such information as it is acquired during the course, and as it may be modified by subsequent experience.
   a. Physico-chemical nature and properties, and their relation to activity. Valuable information in this area is imparted in courses in chemistry and in pharmacy.
   b. The identity of the drug as an individual agent, or as a member of a group of related substances – similarities and differences within such groups.
   c. The response of living cells and tissues to the presence or absence of that drug – mechanisms involved in that response, and their reflection in the function of a physiologic system.
   d. Dependence of basic action upon, or its modification by, such factors as tissue differentiation, blood supply, innervation, methods and routes of administration, individual and species variation, and the concurrent abnormal physiology of disease.
   e. Distribution and fate of the drug in the body, and the influence of these processes on the

manifestation of drug activity.

f. Modification of drug action by the simultaneous administration of other agents.

g. Some recognition of the hazards inherent in drug action — comparative potentialities for good and for harm in its anticipated use.
Quantitation, and its relation to dosage
Individual variation—sensitivity; idiosyncrasy
Habituation and addiction
Principles applicable to the control of hazards.

DISCUSSION

Q: What should we do about teaching a better vocabulary?

A: The crux of the trouble seems to be in the attitude of the student, they have not approached drugs with "respect".
Vocabulary should be included along with what it means.

A: Give short vocabulary quizzes on previous lectures, but this does not afford the students an opportunity to use the recently acquired vocabulary.

A: Students submit 2 papers per year, this enables student to use a much better vocabulary on essay type examinations.

A: Use of vocabulary manual, such as Hoffman's Manual for Medical Librarians. This gives a list of important prefixes, root words, and suffixes. The teacher has prepared a list (mimeo) which is then divided into assignments. These prefixes, root words and suffixes are correlated with the lecture material. The students are required to learn about 8 new ones per week, and about 10% of examinations are devoted to vocabulary. By this method students have been able to recognize bizarre words.

A: There is an antipathy to forcing the student to memorize, but in the final analysis this may be unavoidable.

A: Using the terms as I go along, and on every essay examination includes one question on vocabulary. After this students are using the words.

Q: Are there benefits from the use of a Medical Dictionary in a pharmacology course?

A: Students should have access to one not only in pharmacology, but all through pharmacy school.

A: Students should go to source other than dictionary to get a better meaning.

Part of the objectives of the course should be to instil in the student an ability to recognize medical terminology; and any method which brings about a degree of understanding is a good one.

Q: What should the student be taught concerning intricate mechanisms of action?

A: It is important that the student be given this material because:
(1) For 3 years (in most cases) the student has been exposed to basic terms and drug uses, and this may force upon the student an understanding and appreciation of the effects of the drugs.
(2) It makes the course more interesting to the teacher.
(3) It is impossible to teach pharmacology without including sites and mechanisms of action.

Q: A major problem to be solved is that of a poor foundation in the biological sciences (physiology, anatomy, etc.). What can be done about it?

A: An extended course in pharmacology. but if the student is well prepared all agree that 1 year is adequate.

Discussion, rather than questions and answers on the importance of separating the "wheat from the chaff", i.e. what drugs should be included in the course?

Conclusions:

(1) Drugs of therapeutic merit must be separated from those that have no place in modern therapy.
(2) Teach use vs. alleged use.
(3) Cut of the scope of pharmacology to exclude those drugs with no therapeutic use today. There just is not enough time.

Suggestion to save time: Correlate material taught in pharmacology, pharmacognosy, pharmaceutical chemistry, and biochemistry.

There are many opportunities where pharmaceutical chemistry and pharmacology can be correlated: e.g. In chemistry the lecture on cardiac glycosides in the AM and the lecture on their pharmacology in the PM.

Many believe there should be better texts — a pharmaceutical chemist should enlist the aid of a pharmacologist and vice-versa.

It was pointed out that the best approach to interrelationship between the health sciences is to turn out students who are thinking on a par with other people in the medical sciences. And part of the responsibility of the pharmacology teacher is to direct teaching in the course toward the kind of objective we should like them to attain.

SUMMARY

1. The group agrees with the objectives outlined by Dr. Maher.
2. We should be critical of the drugs selected for study.
3. Vocabulary for the student is an important objective.

HOW I DEVELOP AND PRESENT A LECTURE IN PHARMACOLOGY

FRANK T. MAHER
Section of Biochemistry, Mayo Clinic
Rochester, Minnesota

Our discussion this afternoon is directed to the preparation and presentation of our subject matter to students in pharmacy. By way of introduction, I will indicate briefly certain principles that have guid-

ed my efforts at the University of Illinois, in the hope that from these may originate points for consideration worthwhile to our mutual interests. Our title is not to imply a stereotyped teaching form — rather, I prefer to view each lecture as a problem varying widely with the group to be taught, the material to be covered, and the abilities and facilities of the teacher. Good teaching may be associated with a wide range of methodology, so that a prescription for the effective lecture is neither practicable nor desirable.

Some thought devoted to the place of the lecture in modern education may aid our individual approach to teaching. I have long questioned the necessity or advisability of formal lectures to small groups, and especially in the senior year. Large groups seem to require the lecture method, and this was our experience at the University of Illinois, with classes numbering approximately 100 students. Nevertheless, I like the informality and the intimacy of the small-group discussion, and seek to retain these qualities insofar as possible in lecturing to the larger class groups. Organization is obviously necessary to adequate coverage of the subject matter, and to a proper time distribution in the course progression. Between these extreme concepts of formality and informality I plan my teaching, with the value of the effort to be judged by the student gain rather than by professorial output.

I find it helpful also to recall that most of the material we teach may be found in the textbooks or in the literature. From this, we might conceivably confine our efforts to assigning homework and grading examination papers, and I have no doubt that many students would progress satisfactorily in this fashion. The majority of students will profit materially from proper instruction. I believe that the principal value of our lecture teaching is to be found in guiding the reading habits of the class; in correlating and establishing points of view; and in seeking to clarify problems and disputes as they arise in general reading and study. Students beginning any field of study seem to experience a basic need for a sense of security, and a feeling of accomplishment as the course unfolds. Here I justify some over-simplification for the sake of imparting to the student a firm footing in the early days. This will, of course, be modified with increasing comprehension, and I consider it important that we lay the proper groundwork for comprehension, rather than seek to extend the capacity of our students to memorize.

These thoughts are offered as fundamental to lecture development, in that they aid in establishing an attitude toward teaching, or help to clarify the teaching objective.

Development of the Lecture

I find it difficult to prepare or to consider an individual lecture as such. The first stage in my planning involves a general outline for the entire course, in order to determine the optimal division of the work over the time alloted. In the usual provision for three lectures weekly, over a quarter of eleven teaching weeks, each lecture represents some three percent of the total didactic time. The effectiveness of that lecture hour depends materially upon its place in the total scheme of things for the course and the curriculum.

Within the framework of time provision, I follow the rather general practice of dividing the total allotment into logical segments, seeking to devote to each group of drugs a treatment bearing some proportion to relative value or importance. If I thus find that I can devote ten hours to subject matter related to anesthesia, I prefer to consider this period of time as a unit, relating broad topic headings to time divisions, and considering each to the limit of time available. In this consideration, I like to include:

1. The background, and a brief historical development.
2. Some review of biologic aspects fundamental to the group, including some consideration of pathology in relation to projected usage.
3. A consideration of the basic action of the drugs included, with particular emphasis upon a prototype member of the group where possible.
4. Physico-chemical aspects of these drugs, and the influence of these factors upon action, formulation, and administration.
5. Mechanisms of detoxication and excretion, and their significance.
6. Current status of the group: therapeutic, economic, industrial.
7. Future developments to be anticipated in the group, particularly in areas characterized by active research expansion.
8. Hazards involved; their recognition, and principles involved in their management.

Material presented under these headings must, of course, be kept reasonably current from year to year by library consultation, by the personal experience of the lecturer, or by a sound evaluation of current research in the field.

I consider it important to stress where possible implications in the use of drugs to the activities of the professional pharmacist. It is well to remember the central position of the pharmacist between the patients and the prescribing professions, and to realize that the pharmacist is frequently the first professional person to hear the patient's story. Pertinent examples often concern the manifestation of untoward reactions which may follow prescription medication, or the symptoms of distress underlying requests for over-the-counter medication. The influence of the lecturer upon professional performance all too commonly ceases with graduation; nevertheless, I have found it important, and rewarding, to include biologic and pharmacologic aspects to the general consideration of ethical behavior in the practice of the pharmacist.

We have thus established a series of lectures, with the individual lecture but a portion of the story. The beginning of each lecture hour will be determined by a brief review of the preceding one; the ending will be determined by (a) the effective pace of the lecturer

for that day, (b) the rate of acceptance of the class for the material presented, (c) distractions prevailing, and (d) discussion of points raised specifically by members of the class. These factors have varied so widely from year to year in my experience that I prefer to establish the lecture progression anew for each incoming student group. I consider it more rewarding to seek clarity of understanding, with opportunity for discussion than to plow ahead for a goal of total material presented.

Pertinent also to choice of subject matter is the seeming desire on the part of the students to anticipate in the lectures suitable material for projected examination. This tendency can in my opinion be stimulated by undue stress upon factual items, and by the employment of examinations depending principally upon memory. I have tried to teach understanding and correlation, and have attempted in all fairness to adapt my examinations to this point of view.

Presentation of the Lecture

For the approximately 50 minutes of each lecture, we are competing actively for the attention of students who may at that time be recovering from such distractions as the effects of an insufficient period of sleep, the shock of a major examination during the preceding period, or the excitement of a softball game during the noon hour. I attempt, therefore, to adjust my story to the temper of the class, and gauge my lecture progress by class acceptance. Here I find it helpful to talk to the student as directly and as intimately as I can, to convince the student that I am talking to him, and to encourage him in an interest in what I am talking about. The attitude here is one of informality, with the assumption of a common interest in the subject under discussion.

From this point of view, I prefer to lecture without notes or manuscript, since I believe that these divert the attention of the lecturer from the audience, with an accompanying decrease in interest on the part of the class. Admittedly, there is risk of omitting important details, but I accept the risk, and the attendant need for more careful preparation for the advantages to be gained in student interest, in the enjoyment of teaching, and in an increased flexibility in adapting the progress of the day to student reaction.

Application of audio-visual aids to teaching will vary widely with the desires and ingenuity of the lecturer, and with the facilities at hand. In their use, I have attempted to adhere to certain principles:

1. Demonstrations should be brief and simple, and they should *work*.
2. Specimens and sample materials have been of little use to me in lecturing due to the size of the classes at the University of Illinois.
3. Blackboard usage should avoid overloading and illegibility, and the blackboard message should be readable and simple. I avoid placing complicated material on the boards in advance of class. In general, I have found the blackboard, properly provided and illuminated, to be the most effective single aid to my teaching.
4. Slide projection should be adapted to the lecture room, so that the slide message is apparent to the class. I avoid complicated tables or charts, since the time available may not permit their comprehension.
5. Care in the selection of movies, to avoid the presentation of biased or obsolescent material. Movies tend to be time-consuming in relation to their message, but may afford a valuable variation in the lecture routine.

Much of the success of a lecture, I believe, depends upon a sense of association between the students and the lecturer. Particularly helpful to me in achieving this rapport has been the practice of encouraging questions from the class on points not made clear. or concerning experiences occurring outside the classroom. Similarly, I like to pose an occasional question to the class — such questions should be thought-provoking rather than memory-racking or embarrassing, and time should be allowed for the class to give the question some thought before the explanation is completed. These practices increase the difficulty of adhering to a set outline or scheme for the lecture, but seem to encourage student interest, and facilitate their understanding of material as it comes to them.

Summary

A. I encourage students:

1. to come to class with some recollection of where we left the subject at the close of the preceding hour, and the probable course of continuation.

2. to anticipate a brief review at the beginning of each lecture, and to be prepared to ask questions on previous material not made clear to them.

3. to gain a reasonable grasp of material being presented that day.

4. to feel that I want their interest, and will work with and reward that interest.

5. to leave class with a brief summary of the day's objective, and an indication of the nature of the next lecture or series.

6. to realize the place of the work of the day in the over-all program for the course, and if possible in their total curriculum progression.

7. to be aware of sources for further study, and the nature of the material to be sought.

Students seem to appreciate the practice of indicating in advance the nature of a forthcoming lecture series or topic. In doing this, I have found it helpful to recommend sources for primary and collateral reading and to point out certain study objectives in orienting that reading. I expect some advance reading by the class, and present lecture discussions on that basis.

B. I prefer to avoid:

1. required adherence to a specific text-book for the course.

2. specific reading assignments of "homework" for general study.

3. detailed presentation in lecture of specific data, where this may be found in standard texts or references.

4. lecture presentation from formalized notes, or the reading of a manuscript.

5. an accumulation of notes from year to year, except for reference purposes.

6. directing the lecture content to the anticipated nature of course, final or board examinations.

This introduction to our session for today is not intended to present a format for the ideal lecture. Indeed, it has been my thesis that good lecture results may be achieved by methods varying widely with the individual characteristics of the lecturer and his environment. Use of the first person has been deliberate, in indicating certain principles which have guided my teaching efforts.

Each of us I am sure is making use of technics potentially valuable to the rest of us. I am equally certain that each of us can also correct faults in our procedures following an open discussion such as we propose here. I offer my viewpoint for the purpose of opening our consideration of the lecture in the teaching of pharmacology to students in pharmacy.

DISCUSSION

Q: What should be done about the necessity of placing too much material on the blackboard before the lecture?

A: Place only a list of terms not heretofore seen by students.
Use of handout sheets, for complicated material.

Q: What do you do about students who ask questions as a delaying tactic?

A: Ask them to stop in office after lecture.

Q: How do you avoid detail? And how do you indicate what should be remembered?

A: You can direct the students attention to any portion of any source material, that would give an adequate coverage. This reduces the lecture problem. To save time use one drug as an example of a group and merely indicate the differences. Students should have read on the topic prior to lecture.

Q: Should a beginning instructor pass out outlines of material to be covered?

A: It is advisable to keep a running outline on the board and to lecture without notes.

Q: How would you handle a topic as barbiturates which includes a myriad of drugs?

A: 1. Discuss basic chemical nature.
2. The fact that the drugs come within a group of central depressants would include a comparison between them and other central depressants.
3. Biotransformation of barbiturates as compared to other central depressants.
4. Basic body response to barbiturates, and for purposes of illustration draw comparison with substituents and activity on C5.
5. Select a few types rather than discuss all of them.

The need for caution in accepting new drugs should be injected into lecture.

Q: What sections of pharmacology could be minimized in lecture?

A: Should be approached with a person to person meeting with people in other departments. e.g. Vitamins covered in biochemistry and in physiology. Hormones—include only those with pharmacological action and eliminate those with replacement therapy.

A: Regional variations—e.g. minimize antimalarials in north.

Q: How do you correlate different departments?

A: Staff meetings, meetings with the other colleges, and just friendly get togethers.

Q: How do you approach the problem of general anesthetics?

A: Hand out mimeo sheets with structure and function of central nervous system. And correlate central depressants and stimulants.

Discussion of whether or not general anesthetics should be part of syllabus.

1. Should be included but reduced.

Cont. of what classes of drugs to be reduced or minimized.

An area to be deemphasized may be emollients, demulcents, and antiseptics (covered in bacteriology.)

Q: Isn't it possible when lecturing without notes to give examination questions on material that was never discussed?

A: I use full lecture notes, but do not read them in class. They are used as reference. Notes are read before class, marginal notes made.

A: I do not approve of taking notes into class, but also do not approve of a slipshod lecture. One should not get into a rut and give the same lecture year after year.

A: At the beginning of my teaching career, I went to lecture without notes and received the nickname "Machine-gun". Now I take notes into class and have slowed down considerably.

The group agreed that there should be a lecture system, which will give the student a complete outline of the lecture material. The lecture should consist of salient material.

There is general disapproval of "spoon feeding and regurgitation" in pharmacology. A method of eliminating above is: At end of each general topic a student is required to submit a resume of the topic, both brief and concise. This is done for the two-fold purpose of having the student use the literature, and to see if the student can write and express himself. This was later modified to include discussion groups. Students seemed to like this very much.

SUMMARY

1. The lecture is the most effective means of presenting pharmacology. Aids should be used i.e. well-lighted blackboards, etc. Without a doubt the biggest single aid is the blackboard.
2. Pharmacology teachers should not be expected to

spoon-feed student.
3. It is important to keep the fundamentals as part of the course.
4. Lectures should be geared to make the students think.

"COURSE PLANS IN PHARMACOLOGY AND HOW I DEVELOP THEM"

By L. D. Edwards*
Purdue University

This presentation outlines the general plan of and the teaching methods employed in the undergraduate course in pharmacology required for graduation by the pharmacy curriculum of Purdue University.

Origin of Course

In 1936, the writer was directed by the Schools of Pharmacy and Dentistry of Western Reserve University to set up a combined didactic and laboratory course in Pharmacology which would serve the needs of the curricula of both of these schools. The move had the complete approval and encouragement of the Department of Pharmacology of the Medical School. In fact, all the laboratories and equipment of that department were made available for use in this new course. The actual plan of the course, which received the approval of all three areas, consisted of two lectures per week throughout an academic year and one two hour laboratory period per week during the second semester. As was the practice in the medical pharmacology course at Western Reserve in 1936, the laboratory work of the course under discussion involved demonstration only. The demonstrations selected for the laboratory phase of the course were identical with those used in the medical course and were intended to survey the techniques then commonly employed in the laboratory area of pharmacology. The lecture topics, as well as their sequence of presentation, followed the pattern as used in the textbook selected for the course — A Manual of Pharmacology by Sollmann. Since there were at that time very few pharmacology courses offered to pharmacy students to serve as prototypes in the planning of such a course, it was only natural that we should seek aid and advice of our medical friends. Their response, as noted herein, was most generous and I assure you it was equally appreciated.

As I review the origin of this course at this time I am struck by the absence of many practices now considered essential to the establishment of a course in any curriculum. There was no exact definition of the proposed course laid down; no detailed objectives were spelled out; little thought was given to auxiliary references for the course; various teaching aids were not thoroughly explored; and methods of examination and grading certainly received only passing attention. Possibly all these requirements were satisfied in an indirect way, but they were never formalized in the nature of a document of course introduction. This "hit or miss" procedure is still extant; too many of our course introductions by both young and old instructors alike are merely adaptations of courses of which they have some knowledge. If we could correlate our past experiences and the advice that we receive with some original, sound, pedagogical thought on our own part, I am of the opinion our courses would not only be more profitable to our students but more interesting to ourselves as well. Possibly this is asking too much of some very young instructors but as they progress they should show signs of original thought concerning the planning and presentation of their courses. Such progress on the average should appear sooner and be of a higher quality in the case of the young instructor who has been exposed during his graduate training to an organized course in course-planning. The responsibility of informing our pharmacology graduate students planning to enter the teaching field of this advantage, of course, rests with our graduate counselors. The term counselor is used here in a very general way, since it is appreciated that the graduate student seeks or is exposed to counsel from many sources.

Present Plan — Didactic Phase

After many years of existence during which many changes in plan have been effected our course in pharmacology now has been formalized to the point that a course plan is on file in the Dean's Office. Undoubtedly the Dean can make use of these course plans on a number of occasions, but I am sure that the individual instructor receives the greatest benefit — it makes him think a little bit about his course as an entity. Our plan shows the following:

Definition

"Pharmacology as presented in Pharmacology 540 and 541 is a *survey* of the changes effected in normal living organisms, tissues and cells by chemical substances that are used for the most part as therapeutic agents — biological assays, toxicology and posology are included." The essential thing here is that the course is classified as a survey course. With only one such course in the pharmacy curriculum there is probably no other choice, and every effort should be made to truly survey the fundamental principles of pharmacology. The old materia medica type course cannot be accepted, at this late date, as a substitute.

Objectives

The objectives of any course should be clearly stated at the outset of planning and an honest effort must be made by the administration and the instructor alike to achieve these objectives. The importance of this phase of course planning is magnified with the appreciation of the part it plays in the overall nature of the course as well as in the choice of the teaching methods of presentation of the subject matter. Further, the objectives that pharmacy establishes for its courses in pharmacology will determine to a large extent the degree of recognition accorded us by fellow-workers in the field of pharmacology. In the Purdue plan we find the following set of objectives:

As a result of the study of pharmacology the pharmacy student should acquire:

1. An *understanding of the fundamental principles* concerned with the action of drugs and poisons.
2. Where possible, a *detailed knowledge of the mechanism of the action* of drugs and poisons.
3. *General knowledge of the principal therapeutic uses* of drugs with recognition of the limitations of his knowledge in this field.
4. *Familiarity with the various aspects of posology.*

* Died October 29. 1954.

5. Knowledge of the *general principles and procedures of biological assays.*

6. *Knowledge of emergency treatment* and *antidotes useful* in acute cases of poisoning.

7. *Familiarity with sources of pharmacological information; ability to read and to evaluate pharmacological literature.*

8. *Knowledge of the pharmacological background of drug regulations and the control of drugs.*

Pharmacy provides an environment which permits the full achievement of these objectives; the need for this achievement is recognized. Therefore, our courses should be planned and conducted accordingly.

Time Allotment

The time allotted to our course in pharmacology which is given during the fourth year of our curriculum, now consists of three lecture hours and one three-hour laboratory period throughout the second semester. Recently, it was decided to revise this time allotment to two lecture hours and one three-hour laboratory period for both semesters. This decision was based on the conviction that the laboratory method of instruction in pharmacology possesses many advantages and that careful planning of lectures would offset the loss of time in that area.

Prerequisites

Currently, courses in Biology and Physiology constitute the prerequisites for enrollment in our pharmacology course. These requirements could be greatly strengthened with the addition of comparative anatomy and histology. Without the proper biological background, the student can only do memory work in pharmacology; he can not hope to do any pharmacological thinking. From a chemical standpoint our students are, of course, well prepared. Further, this control of the background of the entering student provides the teacher with some definite foundation for his course plans and teaching methods. At times, I have entertained the idea that in order to best serve the two main areas of pharmacy, Retail and Scientific, two separate courses in pharmacology should be available, each with prerequisites and course contents fitted to their special needs. But such an approach would probably result in one course being very inferior to the other, and lead to no end of trouble. Then, too, if our course is to be a survey of general principles, how can the course differ with the type of pharmacist being trained?

Text and General References

A number of pharmacology textbooks which are well suited to our use are now available. Currently we use *Pharmacologic Principles of Medical Practice,* 2nd Edition, by Krantz and Carr. At the time of its adoption it was the then most recently published pharmacology text. The students and our staff have found it to be satisfactory in every regard; hence, our present plan is to continue with this text. The larger texts tend to overwhelm the beginning student, and often are rather expensive. In addition to the above text we require the purchase of a good medical dictionary – *Blakiston's New Gould Medical Dictionary* is recommended. General references cited to the class include *A Manual of Pharmacology* by Sollmann, *Pharmacology and Therapeutics* by Grollman, *Textbook of Pharmacology* by Salter, *Pharmacology in Clinical Practice* by Beckman, *Clinical Toxicology* by Haley and Thienes, and *The Pharmacological Basis of Therapeutics* by Goodman and Gilman. From time to time a reading assignment of a pertinent article in one of the standard journals of pharmacology is made to acquaint the student with this source of information. The U.S.P., N.F. and N.N.R., of course, are in the hands of the pharmacy student.

Course Content and Schedule – Didactic

With a given amount of time at his disposal one of the most important functions of the teacher is to weigh the topics to be presented in his overall course, and to treat them accordingly in his time schedule. This is difficult, and too often when little thought is given to this item unbalanced pharmacology courses result. Some instructors especially interested in chemistry may give that area too much emphasis; others may give too much time to some research they are conducting at the time. From the pharmacy standpoint, less time devoted to the general anesthetics as compared to that of the barbiturates seems to be justified. Also the choice of topics and the weight given to them must reflect a correlation with other related courses given in the pharmacy curriculum. Some repetition serves a useful purpose, but when it becomes excessive it leads to boredom. Undoubtedly, this last consideration will give in different schools a different weighting of topics.

After the selection and the weighting of the topics, it is then necessary to arrange them in some sequence for presentation. Since there is no classification of drugs which is satisfactory to all concerned, this becomes very arbitrary. Our policy is to review the more or less locally acting drugs in the first semester, and the drugs acting systematically the second semester. The topics, time allotments and text assignments of the Purdue sequence follow:

First Semester

Week	*Lecture Topic*	*Text* (Krantz and Carr)
1	1. General principles 2. General principles 3. General principles	p. 1-51 p. 52-89
2	4. General principles 5. Demulcents and Emollients 6. Demulcents and Emollients	p. 291-294
3	7. Irritants and Counter-irritants 8. Irritants and Counter-irritants 9. Irritants and Counter-irritants	p. 295-301
4	10. Drugs acting on the G.I. tract 11. Drugs acting on the G.I. tract 12. Drugs acting on the G.I. tract	p. 362-384
5	13. Anthelmintics 14. Anthelmintics 15. Anthelmintics	p. 275-290
6	16. Antiseptics 17. Antiseptics 18. Antiseptics	p. 302-339

Week	Lecture Topic	Text (Krantz and Carr)
7	19. Antiseptics 20. Antiseptics 21. Antiseptics	
8	22. Sulfonamides 23. Sulfonamides 24. Sulfonamides	p. 118-146
9	25. P.A.S. and Sulfones 26. Antibiotics 27. Antibiotics	p. 228-249 p. 147-207
10	28. C.N.S. Stimulants 29. C.N.S. Stimulants 30. C.N.S. Stimulants	p. 607-628
11	31. C.N.S. Stimulants 32. C.N.S. Stimulants 33. C.N.S. Stimulants	
12	34. Opium and alkaloids 35. Opium and alkaloids 36. Opium and alkaloids	p. 498-540
13	37. Opium and alkaloids 38. Opium and alkaloids 39. Opium and alkaloids	
14	40. Local Anesthetics 41. Local Anesthetics 42. Local Anethetics	p. 340-362
15	43. Local Anesthetics 44. Local Anesthetics 45. Local Anesthetics	
16	46. Miscellaneous Topics 47. Miscellaneous Topics 48. Miscellaneous Topics	

Second Semester

Week	Lecture Topic	Text
1	1. Autonomic Nervous System 2. Autonomic Nervous System	p. 629-641
2	3. Parasympathetic Depressants 4. Parasympathetic Depressants	p. 713-740
3	5. Parasympathetic Stimulants 6. Parasympathetic Stimulants	p. 688-712
4	7. Sympathetic Stimulants 8. Sympathetic Stimulants	p. 642-673
5	9. Sympathetic Depressants 10. Nicotine and Quaternary Ammonium Compounds	p. 674-687 p. 741-755
6	11. Curare Compounds 12. Ergot and Alkaloids	p. 478-482 p. 894-909
7	13. Histamine and Antihistamines 14. Renal Hypertension	p 756-774 p. 827-831
8	15. Blood Coagulation 16. Posterior Pituitary	p. 844-860 p. 904-909
9	17. Sex Hormones 18. Sex Hormones	p. 910-933
10	19. Adrenal Cortex 20. Adrenal Cortex	p. 969-976 p. 986-997
11	21. Nitrites and Organic Nitrates 22. Digitalis	p. 831-843 p. 783-811
12	23. Digitalis 24. Amoebicides	 p. 264-275
13	25. Amoebicides 26. Cinchona Alkaloids	 p. 90-117
14	27. Cinchona Alkaloids 28. Cinchona Alkaloids	
15	29. C.N.S. Depressants 30. C.N.S. Depressants	p. 409-495
16	31. C.N.S. Depressants 32. C.N.S. Depressants	p. 541-586

The subject matter included in a topic must, of course, be constantly revised — new drugs must be added and out-moded material must be deleted. A pharmacology course can go "to seed" in about five years.

In the actual presentation of a topic, we have found it advantageous to first review any special anatomy or physiology that may be involved. In the case of the autonomic nervous system considerable time is given over to this review, with other topics little or no time needs to be so consumed. Next, the topic is approached in a general way, for example, as in the case of the digitalis glycosides it can be brought out that the resultant actions on the heart of several glycosides are qualitatively similar. Finally, any important special items are given consideration. Here, the poor absorption of streptomycin from the G.I. tract as compared to the absorption of other antibiotics serves as an example. At times, some oustanding member of a drug group may serve as the "whipping-boy" of that group. With the pharmacology of the type-drug thoroughly reviewed, only the exceptions exhibited by the other members of the group need to receive attention. Probably there is a "best" way for the presentation of each topic, and the good teacher will be quick to alter his general plan of presentation in order to secure any added effectiveness. Further, any deviations in the manner of presentation tend to arouse interest; the same technique repeated over and over throughout a year-course can become depressing to the students and teacher alike (I am thinking of the old forms used in some pharmacology courses).

In my own lectures I make free use of charts and graphs in the belief that this is an aid to the student as well as permitting the coverage of more material. Movies are also used, but only after the topic has been developed through the lectures — movies are too rapid

for some minds to follow in the case of a new subject. Special mimeographed sheets can be very helpful; we use them to present such subjects as the life-cycle of the malaria parasite, autonomic responses, etc. These mimeographed sheets should be kept to a minimum to achieve their greatest effectiveness.

I have been told that I, in order to secure student interest, like to tie the drug under discussion to some objectionable personable experience. This "Jack Benny" technique must be practiced with care to avoid eventual class depression. Many of our pharmacy students are extremely practical; hence, greater student interest may often be obtained by showing the practical value of the subject under discussion. Some teachers because they are what they are may employ one teaching technique to an advantage while another group of instructors would achieve little success with the same technique. Therefore, when it comes to "how" to teach each instructor must analyse not only his material and his students, but himself as well.

Examinations and Grading System

During the first semester of our course, an essay type examination is given every two weeks over the material covered in that period. The present-day student is greatly motivated by an examination, and often that is the only time he does any serious study. Hence, we feel that frequent examinations serve a good purpose. Since our experiences with the true false type of examination have led to the belief that the student loses a distinct benefit when he is not permitted to put his thoughts about drugs into writing, we still retain the old essay type of examination.

The lecture examinations during the second semester are on a monthly basis and constitute two-thirds of the final grade; the laboratory grade including notebook, quiz grade, attendance, attitude, and general laboratory abilities constitutes the final third of the course grade.

Our system of examinations and grading is fully explained to the class on the opening day of the course – there is no doubt in the minds of anyone as to *how* the grades are to be determined. Also, our feelings concerning attendance are made crystal clear at this time – this is necessary since attendance of classes at Purdue is strictly a student-instructor affair. We feel that the least a student can do is to attend all classes, and if he elects to do otherwise he must be prepared to pay a high price.

Purpose of Review

It is not claimed that the Purdue course is planned to meet the needs of every pharmacy school – the review of the plan of the Purdue course and methods used therein is offered at this time solely as a basis for general discussion on the subject of Course Plans in Pharmacology for Undergraduate Pharmacy Students.

DISCUSSION

Q: Was there any particular reason for putting Central Nervous System stimulants at the beginning of the first semester and leaving the central depressants for the last part of the second semester?

A: The arrangements of drugs for lecture is arbitrary, and there is no rhyme or reason why the depressants should follow the stimulants.

It was suggested as a time economizer especially in relation to physiology and anatomy of the nervous system to give the stimulants and depressants following one another.

Q: Can you follow your lecture schedule as outlined in the paper very closely?

A: Yes.

A: One man says he doesn't know how much he can get into his lecture because of questions and answers, and because of brief reviews of physiology and anatomy.

Q: Should one spend more time on a topic that one is particularly interested in, or should one be disciplined in his planning, with the proper time allotted to each subject?

A: Time should be allotted to each portion.

To fit the lecture schedule in, if one runs over in one spot, then the thing to do is cut down at another. But it is important to maintain some lecture schedule.

Use of Rx surveys to calculate time allotment of drugs. An important fact derived from a survey would show which 85% of drugs in that area are being used, then it would be important to cover those drugs.

Q: How far should one go in correlating drugs with trade names?

A: This is a job for Dispensing.

Q: In planning do you anticipate handout materials, visual aids, and other supplemental material?

A: There are standard handouts of mimeo sheets compiled over the years. The department has purchased movies to be used.

Discussion on movies–

1. In one school one hour outside of pharmacology syllabus devoted to movies every other week, and for this there is a small fee to students.
2. Movies used in lab periods as they are cheaper than animals.
3. Films presented give a clinical viewpoint, and this would be the only place the pharmacy student can get this information.
4. Films:
   a. Select them because you NEED them.
   b. Give thought to how and why they are handled.
   c. Student should be "briefed" for film.
   d. "Milk" the film when its over.

Q: How do you keep up with the field?

A: Library has a new journal table, teacher makes notes of those that fit into his course. Reads, gets reprint, and that pertinent material drops into file of lecture material (each general subject has a file folder)

A: Jr. of A.M.A. keeps me up to date. Place yourself on MD mailing list of pharmaceutical companies. NNR page in Jr. A.M.A. Use of the Jr. A. Ph. A. (practical ed.)

It should be noted, someone said from the floor, that keeping ones self up to date is not keeping the course up to date.

Course planning should NOT be static but dynamic and flexible.

SUMMARY

No course plan can be expected to be useful in every situation. The problem is how to correlate phar-

macology with other related subjects, since there should be no necessity for giving the material twice.

"HOW I PLAN AND ORGANIZE THE LABORATORY WORK IN PHARMACOLOGY"

By L. D. Edwards*
Purdue University

The plans for the laboratory phase of the course in Pharmacology should follow the same basic concepts as outlined for the lecture. The laboratory should present type experiments which tend to survey the laboratory field as far as is possible. Many claim that the laboratory and the lecture should be coordinated but in our present set-up with laboratory only in the second semester this is not possible. I cannot say that this arrangement has put our students to any serious disadvantage, nor do I expect that when we do have a laboratory each semester that complete correlation of lecture and laboratory will be effected. Correlation of this nature is probably desirable, but is never completely possible.

Instruction by means of the laboratory has been a general practice in many disciplines for many years; therefore, it does not seem necessary to justify the use of this tool in teaching pharmacology. Certainly, the laboratory provides a very practical and common sense approach to knowledge. Students have told me many times that the book-world and the laboratory-world are as different as day and night; that when they actually do an experiment the knowledge they so gain really becomes a part of them. In fact, pharmacology for the most part consists of methods to show the action of drugs on intact animals or isolated tissues or cells; thus, a course in pharmacology would be most incomplete without some laboratory. The chief criticism of laboratory work in pharamacology is that it is expensive. This is true, but if the student receives his money's worth in any laboratory he receives it in pharmacology. A large share of the costs involves the care and use of experimental animals; here, good management and selection of experiments can materially reduce this expense.

Our main objective in the laboratory is to survey the methods and techniques employed to demonstrate drug action, and to show how the results so obtained can be used in our pharmacological thinking. We do not feel that our students develop any specific skills to any very high degree; it is rather difficult to do this when an entirely new experiment is conducted only a single time. However, he can gain a fair idea of the current pharmacological techniques, and he can begin to think in the terms of laboratory pharmacology. A second objective is to supply an appreciation to the student that there is a difference between "learning by doing" and "learning by reading". The third objective is to convince the student that it is still absolutely necessary in pharmacology to test all ideas, original or those gained through reading, in the laboratory to reach a safe evaluation. In the matter of the presentation of the different experiments, demonstrations would be most compatible with the survey type of laboratory, but with all experiments given as demonstrations the "learn by doing" objective would scarcely be gained. It is for these reasons that our present laboratory consists of some individual experiments and some demonstrations. The demonstrations enable us to cover more ground, and also in some instances to reduce costs. The individual experiments while more costly and less expertly done cultivate the desire to "learn by doing". Some of our demonstrations are either replaced or supplemented by means of films and slides. Often times demonstrations, slides and films are justified on the grounds that the student has already performed in some other course a similar individual experiment and therefore would gain nothing more by actually doing the experiment than he would by seeing the demonstration or film or slide. Unfortunately, the pharmacy curriculum is not strong in the biological sciences; thus, it is seldom that our students have performed a similar individual experiment.

In the actual choice of the experiments several points must be considered. First, the experiments must show some special point and at the same time be relatively simple. Very complex experiments performed with complicated apparatus tend to create confusion in the minds of beginning students. Secondly, the experiments should be time-tested to give good results. No one appreciates acceptable results more than does the beginner. If experiment after experiment yields nothing but failure the student begins to doubt the value of such a discipline. Thirdly, it must be possible to complete the experiment within one laboratory session.

After the selection of the experiments on the survey basis a sequence must be arranged. Some experiments seem to have a natural place in the laboratory sequence, but others must be arbitrarily assigned to a laboratory period. If the experiments require little time several can be performed in one session. The Purdue sequence represents a compilation from many sources and is as follows:

PHARMACOLOGY LABORATORY

Week	*Experiment*
1	Chloral hydrate. Pharmacological actions on the frog.
2	Various methods of administration to small animals.
3	Variation in response to drugs. Sex variation in the rat. Calcium-Magnesium antagonism in the rabbit (Demonstration).
4	Species tolerance (Strychnine in chickens) — (Demonstration) Hypersensitivity, anaphylactic shock as shown in the guinea pig using egg white. (Demonstration). Synergistic action of drugs-cocaine and epinephrine in the rabbit eye.
5	Histamine-antihistamine using rabbits (Demonstration). Strychnine-site of action using the frog. Strychnine-recording of tetanic contractions of gastrocnemius induced by sensory stimulation. Metrazol convulsions in man; picrotoxin convulsions in frog (film).

* Died October 29, 1954.

6 Aliphatic narcotics-alcohol, chloral hydrate, and barbiturates (Demonstration).

7 Nitrous oxide anesthesia.
Demonstration of the vagus reflex using irritant anesthetic vapors and ammonium hydroxide and their inhibition by cocainization. (Demonstration)

8 Comparative effects of morphine on various animals (Dog, cat, frog, guinea-pig, rabbit, mice, and rats). (Demonstration).
Toxicity (relative) of local anesthetics (mice).

9 Nerve paralysis by freezing (ethyl chloride) using frog sciatic-gastrocnemius preparation.
Surface anesthesia using the rabbit cornea.
Surface anesthesia using the frog's foot (demonstration).
Cocaine toxicity and antidoting with barbiturates.

10 Action of curare using frog sciatic-gastrocnemius preparation.
Action of drugs on the bronchioles (film).

11 Nicotine toxicity in the frog (Demonstration).
Effect of tobacco smoke on the frog (Demonstration).
Nicotine poisoning in mammals (rats).

12 Action of drugs on the intestine (movie)
Action of drugs using the Magnus method.

13 Autonomic reactions of the turtle heart (Turtle heart perfusion).

14 Action of drugs on the uterus (Magnus method).

15 Effects of various drugs on the eye (rabbit). Mydriatics and miotics.

16 Electrocardiograph and electrocardiogram.

The complete laboratory outline is given to the class at the first meeting, and as a rule the experiments are performed in the order listed. At times, however, it becomes necessary to alter the sequence – an expected shipment of animals may not arrive, etc. Much has been made of the assignment of experiments ahead of the laboratory session to enable the student to pre-digest the experiment. From the standpoint of the whole class, we have found this to be of little significance. You cannot hope in this day of mass education that all members of your class will pre-digest an experiment. Further, with the heavy schedules carried by most pharmacy students, the average student is more concerned with the work of today than he is with a laboratory experiment coming up tomorrow. And, finally, the growing importance of extra-curricular activities prohibit the spending of very much time in the preparation for any laboratory. I suppose a student on his own could go to the library to look up the history of a technique and review the theory associated with the same, but until he has done the experiment he does not really know what he is looking for. Possibly it would be better if this time were used *after* the experiment has been completed to write up the experiment in a little more detail.

In general, the agenda for a laboratory session at Purdue includes the following:

(1) Explanation of the experiment to the class.

Our laboratory is equipped with a demonstration desk and chairs which serve this purpose very well. If some phase of the experiment needs to be demonstrated to the entire class, it is conducted at this time. We feel that this procedure is more dependable than self-preparation by the student – possibly, the time is also more profitably spent.

(2) Special demonstrations, if any. As noted in the sequence some of the work consists of instructor demonstrations. At times, some student help is employed. Much can be said for and against this type of instruction; we feel that within certain limits the advantages are worth considering.

(3) Student conducted experiments. These experiments should constitute the heart of any laboratory course – there is no substitute for the actual manual conduction of an experiment. One does not need to teach very long to observe the degree of satisfaction the average student gets from a well self-conducted experiment – he really feels he is becoming a part of his profession. We encourage the student to do all his own work – at times, some students appear to view the experimental results as the important thing, and almost insist that the instructor do the work on their experiment in order to insure good results. We feel that the instructor has already received whatever benefit the experiment has to offer, and now it is the student's turn. The instructor should help, but never should he take over completely.

(4) Oral and/or Written Quiz. Many students are helped by an oral quiz covering the work of a laboratory session. It is true that much of the effectiveness of this teaching method is dependent upon the instructor. Our course does not have a separate quiz period; therefore, we take some of the laboratory time for this purpose. The written quiz motivates just as much in the laboratory as it does in the lecture. A little written quiz involving a simple dosage problem can be most revealing to the instructor and helpful to the student.

All experiments are written up as follows:

1. Title of experiment.
2. Object of experiment.
3. Brief outline of procedure.
4. Observations in detail.
5. Tracings, tables, graphs, calculations, etc.
6. Conclusions.

To construct an elaborate notebook, a great deal of labor is naturally involved. This time possibly can be better spent in pharmacological thinking; therefore, we urge that diagrams of equipment and procedural outlines be subordinated to observations and conclusions. Of course, we have an occasional student who wants to save too much time by minimizing everything. Answers to special questions are included in the write-ups of each experiment. The notebooks should be turned in for review on pre-determined dates.

The laboratory grade obtained from the notebook, oral and written quizzes, attitude and attendance should count a definite part of the final course grade– in our course this is one third.

Laboratory work in pharmacology from a staff standpoint is very demanding – experimental animals cannot be stored on a shelf as chemicals, much preparation is necessary to put on an experiment, and also considerable effort must be expended in "cleaning up" after an experiment; but, even so, the student response over these many years has convinced us that laboratory work in pharmacology is not only worth-

while – it is essential. It is in the laboratory that the student begins to generate scientific thoughts of his very own; when he does that we can say he is well on his way to a true education.

DISCUSSION

Q: How long is the lab period at Purdue?
A: 3 hours. The lab hour should be adjusted according to school and needs.
Q: What is the optimum size of the group working together in the lab?
A: 2 is ideal, but one must be practical and alter the size of a section.
Q: Who prepares the drugs?
A: They are prepared pre-lab. but students set up own apparatus. The students are not assigned equipment, they are given a box with everything in it.
Q: What do you do with timid students with an aversion to animals?
A: Encourage them. Allow students a little time to get used to the animals.

Comments on integration of lab and lecture.
e.g. first lecture is on routes of administration, First lab:

1. shows a movie on use and care of syringes and techniques of injection
2. In lab there are animals of all types, allows students to transfer from cage to cage.
3. demonstration of routes of administration.
4. students do experiment on routes with supervision, and some timidity is lost.

Q: How much in dollars per student are you budgeted?
A: No one knows exactly but,
   1. One should keep their research program and undergraduate program together
   2. About 10 dollars per student (undergrad)
   3. Improvise and build to reduce costs

The cost of the lab will depend on the ingenuity of the man running it.

Q: In a lab course of only one semester there still is correlation. Take up in lecture when there is no lab such material as chemotherapy. Where there is good correlation students get more out of the lab e.g. autonomic drugs, curare, etc.
Q: How would you handle a student experiment and demonstration in the same afternoon?
A: There is no rigid method, the demonstration can come before or after the student experiment.
Q: How does one give an oral quiz and how does one grade it?
A: Oral quizzes are not graded, they are actually discussion periods. There are short unannounced quizzes in the lab periods, and they are weighted heavily. Comparison of lecture grades and quiz grades shows good correlation.

Scope of lab should include experiments on mammals, toxicology of household poisons.

A great interest was shown in non-terminal experiments with dogs. The use of animals over and over depends on ingenuity of teacher.

Q: Would you use animals over again if there was no cost problem?
A: I am not directed by costs, but what one gets out of an experiment.

SUMMARY

1. There should be thought and consideration to the lab.
2. In so far as possible there should be correlation of the lab with the lecture.
3. Agreed that lab instruction is desirable and that costs depends on selection of experiments.
4. Try to do experiments that are non-fatal.

HOW I CONDUCT A LABORATORY IN PHARMACOLOGY

MORTON J. RODMAN
Rutgers University

I. *INTRODUCTION*

I want to begin by hastily disavowing the suggestion of omniscience implicit in the title of this talk. I think that I would, in any case, have felt some qualms about coming up here to tell a group of this sort how to conduct a laboratory course in pharmacology. But I found myself doubly disturbed by the title, which, with its bold thrusting forward of the first person singular, seemed to indicate that here was yet another "expert" come to set you straight. So I want to make it quite clear at the outset that I make no pretensions to speaking with the voice of authority. On the contrary, I trust that it will be obvious enough that I myself still have so much to learn about how the laboratory may best be conducted that none of you will hesitate to get up yourself during the discussion period and tell how you conduct your own laboratory. For the true value of this meeting will be determined by the quality of the general discussion rather than by what any one individual, of comparatively limited experience, may have to say.

I trust, then, that you will understand that my excessive use of the first person does not imply that I have all, or even many, of the answers. This highly personal account of how I have met and attempted to solve problems common to all of us is intended only to provoke each of you into giving the group the benefit of your own personal experiences.

Consequently, I will avoid the customary broadly philosophical generalizations concerning the importance of pharmacology in the education of the modern pharmacist. Instead, I shall plunge immediately into a consideration of the practical problems involved in planning, organizing, and conducting a laboratory in pharmacology, and I will try to illustrate my points, where possible, with actual examples from my own experience.

II. *PLANNING THE LABORATORY*

Proper planning of the pharmacology laboratory requires first the formulation of one's desired objectives, and, then, the selection of experiments that will most readily bring about the attainment of these goals.

1. *Objectives*:—The chief objective in my own laboratory has been to illustrate, in dramatic and interesting fashion, the pharmacological principles that are

being constantly stressed in the lecture portion of the course. Thus, the experiments we do are chosen not only to demonstrate the pharmacological action, therapeutic uses, and toxicity of a particular drug or group of drugs, but also, wherever possible, to show simultaneously the influence of such factors as biological variation, method of administration, and the manner of biotransformation and excretion on the way drugs act. Similarly, while studying the pharmacological effects of a drug such as digitalis, for example, we may try to introduce certain elementary but basic concepts of bioassay and statistics.

A secondary aim in my course is to give the student some insight into the methods by which the experimental pharmacologist evaluates the qualitative and quantitative activity of various groups of drugs. In my experience, it has been possible, even without the use of elaborate equipment and complicated technics, to instil in the students an awareness of the importance of controlled and properly designed experiments and of the necessity of basing conclusions on results obtained from adequate numbers of experimental animals. Such understanding is vitally important, if the future pharmacist is to interpret and evaluate laboratory and clinical data on new drugs.

2. *Selection of Experiments*: (a) *The Published Manual vs. the Personal Selection of Experiments.* I think that the first step toward accomplishing these objectives is to prepare or have the students purchase a laboratory manual containing experiments especially selected for the ease and simplicity with which they illustrate the important points and principles. In my own laboratory, I use the manual published by the Pharmacology Department of Georgetown Medical School, modified through supplemental mimeographed material in order to conform with our own special situation in regard to available time, staff and equipment.

In addition to the material in the manual and the modifications of it, other experiments are developed based upon research recently reported in the pharmacological and clinical literature. During the past year, for example, we performed experiments dealing with alcohol-barbiturate synergism, antagonism of skeletal muscle depressants, and the treatment of opiate and cyanide poisonings. All these experiments were based on exercises appearing in our manual, but all had been significantly revised in the current literature. Such constant revision of classical experiments in accordance with recent research helps to overcome the disadvantage of inflexibility inherent in the use of even the best of manuals. Attempting to use methods reported in recent papers is stimulating to both the instructor and the student. I know that I get considerable satisfaction when a "dry run" of a new procedure or technic works out favorably; and the student is impressed with the dynamic nature of pharmacology, when he witnesses or performs an experiment in which such relatively new therapeutic agents as Nalline, Tensilon, or Levophed, are employed.

This method – the selection of representative experiments from recent literature – has proved so stimulating to me, personally, that I have toyed with the idea of discarding the manual in favor of this approach to the problem of choosing experiments illustrative of both the pharmacology of each class of drugs and of certain basic pharmacological principles common to all. My present view, however, is that such a treatment is more appropriate to a course at the graduate level and that a manual consisting of classical experiments and technics offers a number of advantages to the undergraduate.

This is true, at least, of the Georgetown manual that we are using. Unlike so many others of the all too common cookbook type, this manual contains a good deal of useful textual material. Each group of experiments is preceded by a review of the pertinent pharmacology and is followed by a summary relating the latter to the clinical implications of the experimental results. In addition, each section closes with a representative bibliography of significant laboratory and clinical reports and review papers on the subject, and a number of useful diagrams and tables.

III. *LABORATORY INSTRUCTION AND SUPERVISION*

Having selected from the manual and other sources, those experiments which it seems will best help us attain our objectives, we must next determine the manner in which the students should participate in the laboratory work. I feel that direct participation in group experiments is best for the student, on the theory that people learn best by doing. On the other hand, the demonstration has many advantages, as a teaching tool. Consequently, a typical laboratory period in our course usually consists of one major demonstration, three group experiments, and a film on a related aspect of pharmacology or therapeutics. Over the years, some of the experiments have been performed by students on some occasions and demonstrated by the staff on others, so that by this time I have developed a set of criteria for judging which method of instruction is most appropriate for the presentation of a particular experiment.

1. *Group Experiments*

Certain experiments are most useful when performed by a group of about four students, each sharing some part of the responsibility. Such experiments require only the simplest technique and equipment. They usually involve only one or two parenteral injections into an intact animal, followed by observation of the pharmacological responses. The student is not usually burdened with the need to consume time and patience in setting up elaborate equipment or in performing technics that require special skills. Thus, animal surgery is limited to such relatively simple procedures as removing the rectus abdominis muscle or isolating the sciatic nerve or sciatic plexus in the pithed frog. The student is rarely asked to set up any equipment more elaborate than that required for kymograph recording of contractions of isolated muscles suspended in the conventional baths. The rationale of all this is that we are not interested in training pharmacology technicians, but in allowing the student to see for himself how the drugs he has been hearing about in lecture act to modify normal physiological functions. We want him to see the toxic effects of various substances and the antidotal treat-

ment of such poisonings; we want to show the pharmacological basis for the use of certain drugs, and even for the uselessness of others. Of course, a certain amount of technical proficiency is essential, if the student is to see what we want him to see. Obviously, improper calculation and administration of doses will result in erroneous observations and conclusions. Thus, the student is given ample opportunity to administer drugs by every route of administration, at first, only after prior demonstration and close supervision by the instructor, and later by himself.

Another criterion I employ in judging whether an experiment lends itself to group participation is the extent to which it permits a division of labors, with the consequent collection of a larger and more diversified body of data than can be obtained in a single demonstration. The observations of all groups are recorded on the blackboard in the form of a table, thus overcoming, to some extent, the disadvantage of working with small numbers of animals, and allowing the instructor to illustrate certain basic principles of elementary biostatistics, as well as the necessity of proper controls and design in the planning of experiments. By having various groups perform different parts of the same experiment, it becomes possible to gain enough information for drawing conclusions that have some statistical significance: For example, in our group experiments on analgesic-antipyretics. we have found it possible, by correlating the data of from 18 to 24 groups, to make valid comparisons as to the relative analgesic potency of Morphine, Methadon, and Acetanilid in rats, and to compare the effectiveness of various physical and chemical methods of reducing fever induced in pigeons by dinitrophenol.

2. *Demonstrations*

Despite the greater overall value of group experiments, circumstances exist in which our ends are best served by having the teaching staff perform a demonstration, while the students make observations and record results. Thus, for example, if I feel that a particular experiment involves the use of apparatus and technics so complicated that the student will be occupied with the set up for too great a part of his time in laboratory, I prefer to present the experiment as a demonstration. For example, I consider the experiment that shows the effects of various autonomic drugs on the blood pressure, respiration and other physiological functions of the dog a very valuable one, and the technics so basic to experimental pharmacodynamics that the students should, by all means, be exposed to them. Yet, at Georgetown Medical School, it was my experience that the average student mammalian team usually required the better part of a morning to prepare the animal and set up the apparatus. While this was permissable in a laboratory that ran 7 or more hours, such lengthy preparation would leave no time, in our own three or four hour laboratory periods for recording results and analyzing them. Consequently, I prefer to perform the carotid and tracheal cannulations, myself, during the hour before the start of the period, in order that the laboratory time be utilized in recording the effects of the various injections. During periodic pauses in the procedure, the students can examine the areas exposed for cannulation, vagal stimulation, kidney oncometry, and laparotomy windows, and I can explain the significance of the recorded results in terms of the sites and mechanisms of drug action.

A further consideration, in addition to that of giving the student time to concentrate on the results and their meaning, is the matter of cost and availability of animals. Dogs for the latter experiment and large "pregnant" rabbits such as we use in studying the effects of drugs on the uterus in situ are relatively expensive and not always in sufficient supply in our area, so that it is frequently not possible to supply each team with an animal, in any case.

To these more or less negative reasons for sometimes preferring the demonstration, I may add its usefulness in showing the students how to perform certain technical procedures of a kind they will be themselves using in later group experiments. Thus, for example, we prefer to demonstrate the insertion of a stomach tube and various other methods of administration before we ask the students to undertake these procedures. Similarly, we demonstrate the set up for recording muscular contractions before we let the students do it. Thus, some experiments are done as demonstrations in order to illustrate a technique as well as to show the actions of a drug.

3. *Films*

More complicated technics requiring the use of elaborate equipment are best presented, if possible, by means of motion pictures. For example, the films on Metrazol and Coramine contain a good deal of experimental pharmacology; the former film describes in detail some pharmacological technics for characterizing central nervous system stimulants and depressants, while the latter includes some very impressive gadgetry. Other films are useful for their presentation of clinical cases that the pharmacy student would not otherwise have the opportunity to see. Thus, the films on Digitalis, Allergy, and Hypertensive Crises, for example, show in vivid detail the various signs and symptoms of congestive heart failure, asthma, hay fever et al and the way in which the afflicted patients respond to drug therapy of these conditions. It is necessary of course that all such films be carefully selected and that they be previewed, so as to give the students a proper orientation on what they are about to observe.

4. *Orientation of Students and Assistants*

I try to make every effort to see that the student comes into the laboratory prepared to get the most out of what he sees and does there and that he understands what he is doing and why he is doing it.

At the very start of the semester the students get a schedule showing the week to week sequence of subjects to be covered in lectures and in laboratory. We try to adhere rigidly to this sequence, so that each week's laboratory experiments will illustrate important points made in the lectures of the previous week. If, as occasionally occurs, the laboratory work happens to deal with aspects of the subject not emphasized in lecture, the student is supplied with a mimeographed summary, stressing the most important points. Thus, if for example, the lectures on curariform drugs or on the local anesthetics did not include material on methods of evaluating drugs for such activity, or if in the series of digitalis lectures, time did not allow a discussion of bioassay methods, the students are

briefed on these matters at this time. In addition, the experiments planned for each succeeding week are listed on the laboratory blackboard during the previous week, along with suggested reading assignments in the manual and the text – all this before coming in to the laboratory.

In any case, I begin each laboratory period with a brief oral orientation, in which I outline the general objectives of the particular period and discuss the various experiments which are to be performed.

I may say at this point, that the two people who assist me – an instructor and a graduate student in chemistry – are also thoroughly briefed each week. Since neither is trained in pharmacology, I hold a weekly conference at which we discuss the purpose and background of each experiment and the possible pitfalls that may occur in performing it. Often, after the first and last laboratory sections of the week, we hold a post mortem to determine how the laboratory may be improved in the later periods of the week or in the following year, and the suggested changes are put into a file pertaining to that particular group of laboratory exercises.

5. *Instructional Procedures*

The importance of properly preparing the teaching assistants for their duties and responsibilities can not be overemphasized; for it is axiomatic that the profit the student derives from each phase of instruction – the demonstration, the group experiment, and even the film – is proportional to the alertness and interest of the instructors. Thus, the teacher must be ready to take advantage of all opportunities to explore the meaning of the many and varied pharmacological responses occurring in the experimental animals; for while any single experiment that we do is intended to elucidate only one or two fundamental facts, the action of drugs on complex animal organisms often results in unexpected responses. Such unusual phenomena can be most profitably exploited, if the teacher is alert to their possible occurrence and aware of their meaning, so that he can assist the students in interpreting them. In the demonstration, for example, the alert teacher has an excellent opportunity to train his class to observe, record, and interpret data under his direct supervision. In our demonstrations, the students do not play the role of passive onlookers. On the contrary, though the actual technical procedures may be performed by the staff, the students are encouraged to share in the task of noting changes in the behavior and functions of the animal and in determining the meaning of such changes. This is best accomplished I think, by an air of easy informality which conveys the idea that we are all working together in a scientific investigation. Thus, the students are free to interrupt with questions and comments at any time and may even talk among themselves. I have found that a relaxed atmosphere around the demonstration table is more conducive to learning than a more rigidly disciplined attitude would be. In the easy give and take that such general participation in the demonstration allows, the students can think aloud, so to speak, about what is going on, and I can correct any misconceptions, as they occur, as well as in my summary at the conclusion of the demonstration.

Similarly, while the students are performing their own experiments, my assistants and I circulate among them, quietly lending a hand wherever we seem to be needed. Such assistance may include checking dosage calculations, aiding in the administration of drugs, discussing the significance of results, and helping the students to draw conclusions from them. In this regard, I may say that though we want the students to learn to think for themselves, we try to answer all of their questions as fully as we can. I'm afraid that I can not, as some instructors do in the guise of encouraging independent thinking, shunt aside questions with the admonition, "look it up" or "figure it out for yourself." I feel that if the student shows enough interest to ask a sensible question, he deserves the best answer we can give him. Often, however, we will answer a question with another question in order to let the student lead himself to the answer. I sometimes quiz all the members of a team in this Socratic manner as a means of providing them with a quick review of the lecture material which the experiment is designed to illustrate.

6. *The Laboratory Report*

The laboratory report which we ask the students to prepare is based upon the format of a typical scientific paper. It includes a brief statement of the purposes of the experiment and the methods employed; a detailed description of the results obtained by the group or sometimes by the whole class, and a discussion section, in which the student summarizes his results and attempts to draw from them conclusions concerning therapeutics and toxicity.

An advantage of a report of this sort is the manner in which it forces the student to apply scientific method in recording, summarizing, and interpreting his data. A disadvantage of such a report is that the student sometimes does not get the expected results and can not, of course, come to any valid conclusion. In such cases, I suggest that the results be reported honestly and stress that the data must not be doctored to fit the facts as the student may actually know them from lecture or from reading the text. His conclusions section should then try to account for factors responsible for his erroneous results, such as errors in technic, administration of doses, or variability in the response of small groups of animals. He can then go on to indicate what results might actually have been expected, had the drug been successful in producing the desired effects.

During my earlier years, I required each student to prepare a report based on the work of his team. Recently, however, because it appeared unrealistic to think that this insured independent thinking, I have bowed to the power of the herd instinct and ask only for a single report from each group. The report is written by the man who had been assigned to the task of recorder for that week, but the three other members of the group are expected to read and sign it and to share responsibility for it. Because the duties of the group members are rotated weekly, each student gets an opportunity to write several such laboratory reports during the course of the semester.

7. *Laboratory reports and other factors in relation to grading*

Ideally, each laboratory report should be carefully

read, corrected, and graded by the instructors. Unfortunately, our staff is too small to permit all reports to be read with the care that is desirable, though all are spot checked, and at least one report from each laboratory section is given a careful scrutiny and returned to the group with appropriate comments.

I do not, however, attempt to assign a grade to these reports, and, as a matter of fact, shocking as it may seem to some, I do not give any separate laboratory grade at all, other than "Satisfactory" or "Unsatisfactory". The latter rating, which I have rarely had to employ, is given not for errors in technique or for failure to guess the contents of an unknown, but only for misconduct, such as failure to handle experimental animals with proper kindness and care, or a general lack of interest and willingness to participate.

Generally, I consider a student's work in laboratory satisfactory, if he makes an honest effort to do what is asked of him, even though he may on occasion foul up an experiment due to technical errors, or render a report that is not all that it might be.

Somehow, I can not see how hovering over our students with grade book in hand helps us attain our objectives any more readily. I feel that students learn better when they are relaxed, happy and interested, and I would rather they be stimulated by the interest and enthusiasm of the instructor than by the threat of a poor grade from him. Thus, I don't believe in springing any sudden laboratory quizzes or in demanding that the students determine unknowns.

This does not mean, however, that the student's efforts in the laboratory are not reflected in his final grade. For, as the student is told, his showing on the major examinations is bound to be better, if he does his laboratory work conscientiously and uses what he learns there to reinforce the material he gets in lecture. In addition, a good number of the questions I ask on the four short quizzes during the semester, are based directly on the laboratory work.

SUMMARY AND CONCLUSIONS

This, then, for what it may be worth to you, is "how I conduct a laboratory in pharmacology." I wish that I could point to even one innovation of obvious value to you. I am afraid, however, that there is nothing new or startling in the way I have tried to solve the various problems inherent in the laboratory. Some among you may even say that I have done nothing but belabor the obvious; others may take serious issue with the way I have handled or failed to handle certain aspects of the situation. What I have done, I think, whether or not you agree with my solutions, is to provide a sort of check list of most of the basic considerations that one must face up to in planning, organizing, and conducting a laboratory in pharmacology. These include: — The necessity of formulating our objectives and keeping both students and teaching assistants constantly aware of what we are trying to do and how we intend to do it; the importance of selecting experiments — whether we use a manual or other sources — that will best enable us to attain these objectives; deciding which experiments are best offered as live demonstrations or in films, and which are more profitably performed by the students themselves; the instruction of teaching assistants in their duties and responsibilities before, during, and after the laboratory period; informing the class of what is planned for each laboratory period as far in advance as possible and then briefing them quite thoroughly at the start of the period; maintaining an alert and interested attitude both while conducting demonstrations and while moving about the laboratory, in order to stimulate a similar interest on the part of the students; the format of the laboratory report; and, finally, the weight which shall be assigned to grading students achievement in the laboratory.

I hope that you have been sufficiently stimulated to tell me, in turn, how you handle these problems and any others that I may have overlooked.

DISCUSSION

Q: Do you have any information as to how many pharmacy schools teach pharmacology without a laboratory?

A: As of 2 years ago, 2.

Too much stress has been made on examinations. To employ discipline may give the opportunity to avoid being stimulating. The use of compulsion deprives the teacher of the necessity of "getting on the ball".

Suggestion was made that all should look at the Georgetown U. Medical School Lab Manual for Pharmacology, and that in this book there is shown the way for good correlation between lab and lecture.

Q: Do you assign a percentage of the course grade to lab work?

A: Not as such. I like to get away from compulsion. I believe what the student does in lab will be reflected in his lecture work.

Q: The weakest point in my set up is lab evaluation. I use my own manual, which includes:

1. Introduction of principles involved in the experiment
2. Materials and equipment required
3. Detailed explanation of procedure
4. Space for data
5. 2 or 3 questions.

The lab manual is never checked, and is used as a study aid. The problem is, what interest has the student in the lab and what is he getting out of it?

If the lab hours are ¼ of total credit, why not gear examinations so that 25% of questions are from the lab? This is quite difficult, and 10-15% is adequate.

Q: Comment on what was said at morning meeting about a student being excellent in lecture work, but a cripple in lab. If the lab is not graded, how could this man graduate?

A: If the student is good in dispensing he should graduate. He is not graduating as a pharmacologist, e.g. if the student doesn't know the techniques of ganglionic blocking agents, but understands it thoroughly, this should be enough.

The problem is are we making physiologists or pharmacologists? We should be thankful that they understand the material.

I do not believe that grading the lab notebook is worthwhile, because I know what goes on, with copying, etc.

Discussion—It is time we dropped the apologetic attitude for having a lab in pharmacology in a college of pharmacy. We should have a more positive attitude.

The total student should be given a total evaluation which would include both lab and lecture.

Q: Should a course in pharmacology in a college of pharmacy be as strong and have the same objectives as a course in a medical school?

A: Yes, in the time allotted. Medical schools get a 7-8 hour lab. Time and money will govern rather than objectives.

SUMMARY

If there were a simple method of evaluation of student in lab we would all be forever grateful.

EXAMPLES OF EXAMINATIONS AND HOW I CONSTRUCT THEM

MORTON J. RODMAN
Rutgers University

In order to comply with the dictates of the title of this talk, I have prepared and distributed copies of the last three final examinations I have put together. These examples will speak more eloquently than I can, concerning my success or failure in examination construction. But before we get down to cases and begin to analyse the questions, and before I begin to make my excuses and explanations, I think that I should try to state my feelings about examinations in general. For, today, after several years of searching my soul for an honest answer to the question of what constitutes a fair and proper examination, I have formulated a philosophy of a sort, which I think ought to be phrased, in all fairness, before consideration is given to the details of individual examinations.

The first question I have had to settle for myself is that of whether examinations are necessary in the first place. Often during the agony and travail of trying to put together an examination that would serve as both a fair and accurate appraisal of the students' knowledge, and, at the same time, as a constructive teaching tool, I have convinced myself that examinations were but a waste of time for both teacher and students. At other times less fraught with frustration, my cooler conclusion has been that examinations, while still an evil, are probably a necessary one in the imperfect academic world in which we work.

I still feel that, under ideal circumstances — where the teacher is truly stimulating and inspiring, and the students really interested and thirsty for knowledge— examinations need not be part of the teaching process at all, either as an adjunct to other teaching methods or as a threatening club.

Next fall, I'm going to get my first chance to prove this theory, when I teach a pharmacology course as part of our Pharmaceutical Extension Service program. Because the course, which is an outgrowth of the demands of workers in New Jersey's pharmaceutical industry, will carry no college credit, and because I expect to be dealing with adults who will make the trek to Newark one evening each week voluntarily, I do not intend to give an examination or quiz of any kind. With a group of this sort, I do not feel that anything is to be gained by stopping the proceedings periodically, in order to conduct an inquisition to determine the precise percentage of information each person has been able to retain and regurgitate. I know already, from past experience, that each student will get out of the course what he puts into it from his own store of brain power, ability to concentrate, and willingness to work. I will know also, by a sort of sixth sense, and without the necessity of examination results to prove it, whether I have succeeded in retaining the interested attention of the class, and whether I have been able, by my own zest and enthusiasm for pharmacology, to stimulate them to read, think, and talk about the subject. These are the only criteria I really require for judging the progress of the students and teacher.

Having thus argued the desirability of dispensing with examinations, I must now admit reluctantly that, on the undergraduate level of instruction, it is neither possible nor desirable to forego them. This is true, in part, because of the demands of the "system", which requires that student performance be assigned a grade, much as in the case of eggs, beef, and other saleable commodities. Failure to conform to this first fetish of academic mores would, of course, result in chaos and confusion too horrible to contemplate. But even beyond the futility of rebellion against the dictates of that greater academic wisdom, the "system", is the need to face one ugly fact — that without the stimulus of a day of reckoning to needle him, the average undergraduate will not willingly expend the energy or devote the time required to grasp even the basic elements of the courses to which he is subjected. We can not pause here to analyse the habitual unwillingness of the student to get his money's worth out of education. Call it youthful immaturity, a fundamental lack of proper motivation, the result of an over-loaded schedule, or what you will, the fact remains that even the best of teachers can't come close to attaining his course objectives in the face of such general apathy toward learning and outright resistance to studying as characterize the average undergraduate. You know only too well what I mean, if ever, on winding up a lecture thoughtfully organized to create interest and stimulate discussion and brilliant in its use of simple analogy to clarify complex concepts, you have called for questions and heard the Greek chorus respond with, "Will it be on the exam?"

Faced with the fact that teaching is a two way proposition and that only fear forces most students to carry out their part of the bargain, the teacher soon sees the examination as a weapon, with which the unwilling may be whipped into doing the reading, thinking, and discussing that alone give substance to a subject. It is unfortunate, but true, that rare are the students who respond with spontaneous cooperation even to the best of teachers. The examination, then, is a device that adds to teaching effectiveness in various ways. Before the examination, the student is made to read something other than the sport page and engage in bull sessions concerned with more than the charms of the opposite sex; during the examination, he must, for a brief hour, forsake all other distractions and concentrate all his attention and interest on the subject

at hand; and, finally, during the post mortem, he must pay close attention to the discussion and be prepared to muster all his pharmacological facts, in order to prove that he was robbed by the ambiguity and obscurity of the questions and by the narrow interpretation insisted upon by the instructor. After all, a guy might possibly pick up a point that way!

So, if the examination is indeed to be a useful adjunct to good teaching, how should it best be employed to gain this desirable end?

It seems to me that in order to achieve this purpose, the examination should emphasize those topics which were most persistently stressed in lecture. That is to say, the examination should give greatest weight to those aspects of the course, which were most frequently the subject of comment and discussion in the classroom.

Now I know that there are those who don't agree with this view. There are teachers who feel that the first function of the examination is to force the student to go over all his notes in preparation, and that, this having been achieved, what goes into the examination itself is of quite secondary importance. Thus, according to this view, the exam need be only a spot check without any real reference to the relative weight given to the various topics during the period of instruction.

I can, of course, understand the reasoning behind this point of view, and, as a matter of fact, I go along with it myself, in preparing the several short quizzes I give each semester. Major examinations, however, should closely reflect the course content and objectives I feel, and should not be a haphazard potpourri of questions collected just to fill up space. This is so, first because the appearance of an important point on an examination serves to re-emphasize it, and this is in line with sound pedagogy, which recognizes repetition of basic principles in various ways as a prime requirement of good teaching. Second, the student's morale is strengthened and confusion avoided, when he is quizzed on material which he had stressed in his own studying because of its apparent importance. I remember my own resentment as a graduate student studying physiology in medical school, when at the end of eight weeks of heavy going in many varied aspects of this vast subject, we would get an examination consisting of only four questions worth 25 points each, especially when the questions appeared to have been pulled out of a hat and bore little relation to the topics that had been most heavily stressed in lecture hall and laboratory.

Consequently, I try in my own mid term and final examinations to cover every major topic in one way or another, and I make an effort to give each broad topic an emphasis reasonably well related to that which it has been given during the didactic portion of the course. Thus, the students can relax in the knowledge that only major topics will turn up on major examinations. On the other hand, they know also that they may expect most anything on the four short, 15 minute quizzes that are strategically distributed over the semester to keep the student from straying too far from pharmacology in the period between major examinations. For these quizzes are quite frankly only spot checks on whether the students are reading the textbook and getting the most out of the laboratory, as well as keeping up with the lecture material. Thus, for example, a typical short quiz deals with aspects of experimental pharmacodynamics even though training the student to interpret data of this type is not a major objective.

But, perhaps I had better pause right here to state our course objectives, before trying to show how these are related to the type of topics taken up in the examinations.

Essentially we want to turn out pharmacists to whom the doctor, dentist, nurse, and others can turn with complete confidence for advice and guidance concerning all phases of drug action. We feel that, if he is to fill this role of drug specialist whether it be in the drug store, in the hospital pharmacy, or in detailing, the student must acquire certain knowledge and skills. He should be thoroughly grounded in the principles of pharmacology and able to apply these principles to new sets of facts appearing in the field of clinical therapeutics; he should be able to read and interpret not only every prescription he receives, but also new product information that comes to his attention; and, finally, he should be able to communicate his knowledge to members of the other public health professions in terms that they can understand and respect.

In view of these objectives, it is axiomatic that considerable attention is paid to the use of the specialized terminology of physiology, pathology, pharmacology, and clinical medicine, and that this concern with the distinctive vocabularies of these disciplines is reflected in the examinations. By this, I do not mean that you will find many questions asking directly for the definition of a term, but it will be apparent from the nature of the information sought that the student must learn to think in professional language, if he is to interpret and answer the questions properly.

The questions themselves, for the most part, have to do with the following kinds of information concerning drugs of each of the various classes: — Therapeutic uses; pharmacological actions, including often the mechanisms and sites of such actions; side effects; signs and symptoms of toxicity and antidotal measures; cautions and contraindications; comparative advantages and disadvantages of various drugs and how the latter may be overcome; precautions to be observed in formulation and administration of drug combinations in order to lessen side effects and increase effectiveness; and, finally, facts concerning such factors as absorption, excretion and detoxication and the manner in which these influence for better or worse the onset, duration, and the intensity of the drug's action.

The drugs and products, concerning which information of this kind is sought, are set up on the examination in the form of a more or less complete prescription. The prescriptions are derived from such sources as the current prescription files of local drug stores; the latest supplements to the Modern Drug Encyclopedia, recent reports of the Council on Pharmacy and Chemistry of the A.M.A.; new product literature being mailed directly to physicians by pharmaceutical companies, and advertisements appearing in the latest issues of the medical and pharmaceutical journals. Because the products listed on the examination in pres-

cription form are often so new that many students may not yet have heard of them, the drug components of the preparation are listed parenthetically. Then, just as he would on being confronted with a new product for the first time in actual practice, the student is forced not only to use his factual knowledge, but also to apply his understanding of basic pharmacological principles to the new drug or combination of drugs. I may say that the students themselves seem to find such prescription type questions rather interesting, perhaps because, being practical minded people — sometimes to a fault — they are quick to realize that this is the sort of information that they are going to need to know, if they are to practice professional pharmacy.

The types of questions I have listed seem to fall naturally into categories of varying degrees of difficulty. At least, they have proven effective in practice as a means of differentiating the poorer students from those that are merely mediocre, and the latter from those few that are superior. Thus, for example, it has become apparent that if he is to pass the examination, the student cannot afford to lose credit on the simple questions concerned with the clinical use and pharmacological effects of various drugs. This minimal requirement is in accord with the notion that the practicing pharmacist should know, as a basic minimum, the use for which each prescription he dispenses is intended and the effect that each drug may be expected to produce. To get a somewhat better than average grade, the student should also be able to answer in addition, most of the questions dealing with such matters as side effects, toxicity, cautions, and contraindications, because such knowledge is often of practical importance to the pharmacist who has the desire to serve the physician and the patient more fully. For superior standing the student should show that he understands, in intimate detail, just how and where the drugs he dispenses are acting to produce clinically useful effects; just as in practice, the pharmacist who most frequently wins the respect of the alert physician is the one who can converse with him on his own terms, concerning the sites and mechanisms of drug action.

I notice that I have neglected to mention one type of question that you will find on the examinations I have distributed — questions pertaining to drug dosage. This failure was Freudian, no doubt; that is, I probably forgot this annoying aspect of pharmacology because of subconscious guilt feelings. Because teaching drug dosage is dull, unrewarding, and for the most part, pointless, posology plays a very minor role in my lectures. Yet questions on dosage do inevitably find their way on to my examinations. This dichotomy between theory and practice constitutes the one concession I make to the demands of the State Board examiners. In all other respects, I prepare my examinations without any reference whatsoever to the antiquated concepts that frequently influence the propounding of Board questions in "Materia Medica." In this one area, however, because of the considerable weight drug dosage sometimes carries with the board, and because students tend to postpone the distasteful task of brute memory until the board exam is upon them, I have decided to do my part in prodding the unwilling student toward the inevitable by putting a few of the more important doses on each examination. In order to justify my complicity in this conspiracy against common sense, I try, at least, to choose for inclusion, drugs that might conceivably constitute a danger, if they were to appear on a prescription in accidental overdosage. For the most part, I feel, however, that there is little justification today for demanding doses on a rationally constructed examination, and I hope that the State Board, which has been accepting and using an ever increasing number of questions furnished it by myself and other pharmacology teachers, will listen to reason on this subject also.

Having decided upon the type of topics to be taken up in the exam, one must next decide upon the kind of questions that will extract the information from the student most readily. For the form in which the question is phrased is often vital in making a fair determination of what the student really knows.

Testing student achievement is something of a science in itself, as I have learned by sad experience. Consequently, I hesitate to offer my views in this area of educational psychology. For, like many of you, I entered teaching with no formal training in how to formulate questions, and you can be sure that where pitfalls for the unwary have existed, I have taken my share of pratfalls. Although my ideas in this field are undoubtedly somewhat superficial and possibly even half baked, I will offer them to you in the hope that you in turn will tell me about the kind of questions you prefer and the reasons for your preference.

The most common categories of questions are:— The essay exam; the completion or fill in question; the true or false test; the multiple choice exercise, and the matching or master list type. Each has its advántages and its limitations, and each is best adapted for eliciting information of a particular kind.

As far as I am concerned, none of the various types of tests is as valuable as the essay examination for determining in detail the breadth of a student's knowledge and his ability to marshal, organize and communicate that knowledge.

Unfortunately, however, the size of our class in relation to the numbers of our staff available for grading, is an obstacle that prevents my using questions of this type as much as I would like. Reading and grading the blue books of nearly 90 students is usually a task too time consuming for me to undertake lightly, with the aid of only one instructor and a graduate assistant, neither of whom is completely at home in the subject.

Because of the incomparable usefulness of essay questions, however, I included five such questions on the final examination for the first semester last year. You can see from the various questions that the student had an opportunity to offer full and comprehensive responses, covering the essentials of entire areas of therapeutics (cf. Treatment of malaria and amebiasis) as well as whole classes of drugs (cf. Sex hormones, antacids, cathartics, and poison antidotes.) He could compare the advantages and disadvantages of various drugs, state general measures to be employed, and apply such general principles to particular situations. The students who knew the subject were well satisfied that they had been given ample opportunity

to display their knowledge, and expressed satisfaction with the detailed nature of the questions, which sought to guide them directly toward the type of response desired by telling them, specifically, what kind of information was wanted.

I might indicate here some of the procedures we found useful in facilitating the fair grading of so many blue books, though I won't pretend that any procedure can make the job less burdensome. First, I prepared in triplicate a fully detailed model answer for each question in which the key points were underlined in red and their relative weights were indicated in the margin. I then went over the answers with my assistants, pointing out where possible, what kinds of answers they might expect and how they might handle the grading of the various responses. Finally, we all went to work together on each question, so that we could bring to the attention of the group and immediately clarify any obscurities that might arise, especially during the early stages of the grading of each question. The result of all these precautions was fair and uniform grading based upon uniform standards, despite the wonderfully varied replies dreamed up by some of the students. As you are probably only too well aware, some students have an uncanny knack for giving the right answer to the wrong question, no matter how precisely the questions have been worded, and others bury the correct answers in a mass of verbiage from which it must be extracted at the cost of the conscientious grader's eyesight and sanity.

Because of the difficulty involved in digging the essential elements out of the very crude ore that students often produce in responding to an essay question, I have come to rely more commonly on the completion or fill-in type of question. Such questions usually consist of a short, incomplete statement, followed by a line or two on which the student is required to complete the statement correctly with a word, phrase, or short sentence. While exercises of this sort are somewhat superficial and do not test for comprehensive understanding, as well as the essay type does, it is possible, by a series of such statements, to elicit many of the most important facts from the student.

To avoid ambiguity and to facilitate grading, I work hard at phrasing the statements in a way that will call forth only one correct answer. My efforts are not always crowned with success, however, and there is sometimes an unexpected variety of answers to a seemingly straight forward question. Frequently, for example, I will ask for a specific fact and get instead a general statement and vice versa. It then becomes necessary in such cases to determine which alternative answers are worth full, or possibly, half credit, and which are completely out of line and deserve none.

This variability of responses is due I believe, to the clash in philosophy between what I try to do in lecture and what an examination of this sort tends to bring out. I mean that in lecture, I am constantly trying to organize many isolated facts within a framework of basic principles, in order to make meaningful the larger concepts of pharmacology, so that the student may eventually learn to think for himself pharmacologically; on the other hand to get questions fit for asking on a fill-in quiz, I find it necessary to break down the unified structure I have been trying to build up, in order to furnish fragments of facts for the students to complete. Often, the facts are in themselves not of prime importance, when taken out of the context of the lecture or series of lectures. It is this gap between philosophy and practice that leaves me dissatisfied with this type of question and not the occasional complaints that a particular question is vague or ambiguous. For I have found that the vagueness is more often in the students than in the question, and that what seems ambiguous to the mediocre student is usually crystal clear to the bright one. In order to understand objective type questions, the student must have a background of information beyond the word or phrase that constitutes the correct answer. If he can't recall and correlate this peripheral material, he will naturally be unable to interpret the questions properly. The result is frequently failure to answer the question at all and a loss of all credit. The "all or none rule," so to speak, that operates in the completion type of quiz seems to penalize such students more than would an essay question, on which they would pick up some points for what they did know. It has been my experience, however, that it doesn't really matter, because the relative standing in the class of the good, bad, or indifferent students remains the same, no matter what kind of examination is given. This consistency of student performance is one of the reasons I have reduced the number of examinations I give. Two major exams and four small quizzes each semester are quite enough to establish with complete fairness how a student stands in relation to his classmates, and that number of tests is sufficient to keep from forgetting to study pharmacology for too long periods of time during the semester.

The matching test has recently gained my esteem as a means of ascertaining the ability of students to see the relationships between cause and effect — that is, between drugs and what they will do. Matching questions are especially valuable in a final examination, covering an entire semester's work, or for a state board examination, attempting to cover the whole field of pharmacology. While answering such questions does not demand total recall on the part of the student, he must somehow, have retained the highlights of what was taught in order to make the successful associations that will set lights to flashing and bells to ringing in his mind. The grades on this latest final examination, made up entirely of matching type questions, were generally somewhat higher than usual. This probably indicates that students do better with questions like these and the multiple choice type, in which they know that the correct answer is somewhere in front of them and doesn't have to be hauled in out of the deep blue. As I indicated earlier, however, the relative standing of individuals was substantially the same as usual, and with the few exceptions that prove the rule, most people received their usual grade, after the standards for achieving each grade had been adjusted upwards slightly.

In constructing questions of this kind, I put an unequal number of items in the lists to be matched

in order to lessen the chances of some questions being answered purely by the process of elimination. I usually allow only one correct answer for a given item, however. This latter stricture requires the examiner to exercise caution to eliminate the possibility of a particular statement applying equally to two or more of the listed drugs or vice versa. Another precaution is that the rules of the game be stated clearly and in detail in order to avoid confusion and that each list be homogeneous in its contents.

The greatest advantage of this type of examination is the ease with which it may be scored — as witness a total time of four hours spent in grading this last examination, compared with twenty-four hours spent by the same number of people on the first semester exam, which was half essay and half objective.

Multiple choice questions can also be easily graded, especially by means of a mechanical key. The construction of multiple choice items, however, requires an expenditure of labor, disproportionately high for the results achieved, and there exist very many chances for the novice to tip his hand and inadvertantly leave clues to the correct answer. Failure to use uniform phrasing and simple sentence structure are among the most common faults in this regard. I prefer that all five choices consist of a single word, and that at least four of the items be words that were used in the same lecture or series of lectures. Thus, question 15 on page 7 requires the student to know that Methyltestosterone is used in the treatment of "eunuchoidism." He must also have retained, however, some understanding of the meaning of "virilism," "priapism," and "hirsutism," in order to logically eliminate from consideration these terms, which had been introduced in the same lecture, under the heading of possible side effect of male hormone administration. The fifth choice, "phallic symbolism," is an example, not only of the madness that assails me under stress of constructing an examination, but also of a kind of item, calculated to trap students with so little confidence in their knowledge that they will exchange what they know for the unfamiliar, even when it borders on the ludicrous. You can be sure that a number of students fell for this one and reached for this answer, on the assumption that it referred to something in the text that they had neglected to read.

I will not take time to discuss the true or false questions at any length, because I gave up on this popular type of question several years ago. I know that some teachers make frequent use of true or false questions or modifications of them, but I am profoundly distrustful of this testing technique, or, at least, of my ability to apply it properly. In trying to prevent the student from getting by purely on brute memory — a possibility which I believe to be strong with true or false questions — I probably tended to make my statements too complex. The result was that I never knew whether I was testing the student's knowledge of pharmacology or his general aptitude in reading and reasoning.

Then, too, it never seemed realistic to restrict the student to but two alternatives; professional life isn't often like that. I suppose, on that score, my students would interpret my remarks to mean that I just can't stand giving them a 50-50 chance. Maybe they've got something there, too, for my knowing that the students have copies of every exam I have ever written adds to the woes of exam construction and doesn't serve to engender any tender affection in my breast. It isn't that I begrudge the students these past exams; I have even put copies of old exams in the library, in fairness to the non-fraternity people. I don't, however, want to get a reputation for laziness in this respect, with the result that the students will study only the answers to the previous year's questions and neglect to review the rest of their notes. While the dynamic nature of pharmacology would probably make necessary extensive annual revisions, in any case, I find it quite annoying to be forced to make each year's examinations so strikingly different from those of the previous year. Every other aspect of teaching has become easier with the years, but construction of examinations becomes increasingly difficult, for points that are of major importance in one year are usually still important in the next and must be touched upon on the examination in one way or another. One of these years, under the press of other work, I'm just going to give up and repeat the exam of the previous year, or, at least prepare a synthesis of several old ones. I imagine that the results will be no different from those of other years, and that the students will wind up with essentially the same marks they had been getting all through the semester.

I don't want to leave the impression that I look upon the examination as nothing but a sort of superbomb, poised as a threat in the cold war between teacher and student. Actually, I should prefer to conceive of the examination as merely the final step in the teaching process — summary and review. It is the students themselves, however, who are unwilling to take the examination in stride. Instead, for many mixed motives of their own, they prefer to build a bogie of anxiety and fear about the examination.

Because I don't believe that such emotions and the distrust they generate are conducive to establishing the ideal teacher-student relationship, I have tried, in briefing my classes concerning forthcoming exams, to deemphasize the competitive and punitive aspects, and I try instead to give the impression that we have merely arrived at a logical place in our course to pause and evaluate our progress.

But most students want no part of such a casual and relaxed attitude, presumably because it deprives them of certain psychological and emotional satisfactions that are as life's blood to spirited youth, such as, for example, the need to meet and overcome danger, no matter how vicariously, and the drive to flaunt authority as personified by the teacher, who though he may himself be young, stands in school in loco parentis.

Or perhaps after all, the student's concern with examinations is justified, when failure could conceivably prevent his going forth to practice his chosen profession and delay the day when he can take his place in the world. If this is so, it is only one more reason for the teacher to take seriously his responsibility for turning out a well constructed examination. For what greater glory can the teacher get than the student bestowed accolade, "A fair exam, Sir!," even though he knows that in the student's lexicon this

means merely, "That was a cinch, sucker!"

DISCUSSION

Q: How do you arrive at the weights given to various phases of the course? Do you apportion the time put into an examination (give topical weight)?

A: I give weekly examinations, therefore I do not have to weight them. I weight the examination on the basis of the material given, and apportion the questions on the material covered.

Discussion: In spite of an antipathy toward examinations, the examinations given show good methods. It is not necessary, apparently, to rely on examinations entirely to stimulate students to do good work, as exemplified by European students.

From the floor: If you want to make comparison between American and European students then it would be necessary to compare only the top 10% of American students.

Discussion directed back to examinations.

1. Approval of the Rx type of question.
2. Use of a syndrome or a disease and the students are required to list causes, etiology, treatment, etc.

Q: Do you use statistical devices in grading examinations?

A: Not formally. I take into consideration the overall picture in adjusting what I consider to be a 1, 2, 3, 4, or 5.

Q: Do you construct all of the examinations yourself?

A: Yes, but the only reason is that there are no assistants in pharmacology, otherwise I would let them help. Actually, someone who is not concerned with planning and giving lectures is not qualified to make up the examination.

Q: Do you think that more than one person can honestly and accurately grade an essay type question and come up with the same score?

A: No. But to overcome this, this is what I do. I write out the ideal answer and underline the key points and weight to each question. All of my assistants and I sit down and grade the papers together so that they may ask frequent questions. This works very effectively when I am present. I also spot check the papers I don't grade myself. This method is successful only with supervision.

Q: Don't you find in an essay type of examination that if you carry it over for 2 or 3 days that you may grade one one way one day, and another way on another day?

A: Its very possible. To avoid this, only one question is graded at a time. I also before starting to grade select a few papers from each grade group to see how the answers are running. It is true that one may be more critical at one time, but this way the entire class is graded in the same manner.

A: Make a key and list the points to check for, rather than write out the ideal answer. This might eliminate weariness or forgetting to grade certain aspects.

Q: With essay questions, do you as a rule weight each answer or are they all of equal worth?

A: Answers are weighted.

A: Total number of questions should have no relationship to weight.

A: Why not total all scores during the year and then later convert to grades? Why use the "magic" number of 100%, its not at all necessary.

Q: Do you think it would be advisable for teachers in colleges of pharmacy to take courses in testing and measurement?

A: I think the amount of time it takes is not worthwhile, but I would have liked to have a course.

A: Many men do become good teachers without any formal courses, but the education courses are certainly a short cut.

This seminar has been a success because the methods given were those that were developed through the years. Why not have short cuts?

Teaching methods should not be attained by avoiding the mistakes of others. Education courses shows one how to avoid those pitfalls.

Q: Do you hold students exactly to the USP or NF doses, or do you prefer to give them a range? What do you plan to do with the new USP and NF where there is a range given?

A: I do not expect to change my course much with respect to doses.

Q: Do you permit students who have attained a certain grade throughout the year to be excused from a final?

A: No, it hinders in an objective which is to review all of the material. It prepares the student for the state board.

Q: Purdue has no finals, is there proof that a final is beneficial?

A: It is not harmful to take a final merely as a review for the state board, other than that I agree that a final is not necessary.

Q: In a given series of examinations do you throw out the lowest grade?

A: Yes, on quizzes, but not with the big examinations.

HOW I EFFECTIVELY USE A QUIZ OR DISCUSSION SECTION IN PHARMACOLOGY

GUILFORD C. GROSS
South Dakota State College

The effective utilization of the quiz or discussion period does not rest upon a single definite pattern or conduct and it would certainly be presumptious of me to say that I have a perfect formula for conducting such periods. Undoubtedly, each of us through individual experience has formulated some definite ideas on this phase of our teaching programs and I would be the first to admit that the methods employed by one individual, even though successful in his case, may not be applied to other cases with equal advantage. Naturally, I hope that my practices result in some contribution to the students' understanding of pharmacology, but I hope too, that I shall never become so enslaved to these practices that I will fail to exercise critical self appraisal or fail to be receptive to the criticisms and counsel of others; for it is my firm belief that these are qualities essential to good teaching and when we lose them, we fail as teachers.

It seems to me that little need be said to justify the

necessity for discussion periods in the teaching program for I doubt that any teacher would seriously deny the potential value that lies in the time set aside from his lecture or laboratory work for this purpose. Disagreement undoubtedly exists as to when these periods should be held and how they should be conducted, but I believe we will all agree that they should be an integral part of the teaching program in pharmacology. In my own experience, these periods have been of immeasurable value in the assessment of my teaching methods and consequently in the determination of my future procedures. I do not think that there is any medium which can so effectively bring to light weak points in the students' background or the teacher's own omissions as the discussion period. I know that in preparing and delivering lectures I have frequently made erroneous assumptions concerning the students' background only to find out by subsequent discussions that they were in error and needed to be corrected. Because of this, I have on frequent occasions reviewed basic principles, taking time out from the prepared lecture material to accomplish this. I have never thought it unwise to spend time in this way because it is my conviction that unless the basic principles are thoroughly understood there is little point in going on with advanced work. The discussion period offers an excellent opportunity to review and clarify such material.

I suppose that a good many instructors, especially after having taught a course for some time are apt to lose sight of the fact that the students in their courses are getting the information for the first time, and they may not grasp it as readily as the instructor might expect. In short, the lecture is perfectly clear to the instructor but anything but clear to the student. Such an offense was pointed out to me not long ago when a student, during one of our discussion periods ventured the comment that he had followed a lecture of mine for ten minutes and from then on for the remaining forty minutes he found it to be just a blur. A little checking revealed that he was not the only one in that position. Naturally, I went over the material again and, I hope, with somewhat better results. Again the discussion period served a useful purpose.

There is yet another aspect of the discussion period that I think is of value to the teacher and that is that it serves as an index of the students' interest which, in turn, is a rather good index of the quality of the teacher's work. If we, as teachers, fail to arouse the interest of the student in our courses, we have failed to accomplish what should be one of our primary objectives, for without his interest we certainly cannot hope to accomplish much in our teaching programs. Lack of interest is, in a measure, a reflection on the instructor and I shall have to admit that on more occasions than I care to remember I have been forced to interpret student responses in such a way that it reflected little credit on the quality of my teaching. However, I try to use these occasions for self-evaluation and to garner some good from them in trying for future improvement.

The students' gain from the discussion section is, to a great measure, determined by the extent of his participation. It is his opportunity to ask questions and to have clarified points in the course work which are puzzling to him. It is the teacher's obligation, of course, to encourage these questions for in many instances students through shyness are reluctant to speak up. However, I have found that frequently the question asked by one student will prompt one from another and so on until a rather active session results. The teacher serves an important role not only in directing the questions toward the answer, but also by intervening at proper times he may revive a lagging discussion.

Before going into the methods that I employ in the conduct of my quiz and discussion section, I should like to say that I am fully aware of the necessity for different approaches by the teacher of the large class and the teacher of the small class. My experience has been limited to small groups — those from 25 to 50 students, and I would certainly not say that the methods I employ could be adapted to classes of 100 or more students. First of all, I have not found it necessary to set aside regular periods for quizzes or discussion. However, it has been my custom to utilize part of each laboratory period for this purpose, and I also leave some time at the end of each lecture, if possible. Our laboratory sections are small. Last year we had two sections of 18 and 19 students each, and groups of this size lend themselves well to discussion sections. I try to allow sufficient time at the conclusion of each experiment not only for adequate consideration of the experiment itself, but also for questions and general discussion of pertinent topics. To allow for this time, I try to keep the experiments short and to the point, and I have long since ceased to require detailed reports on the exercises or to have the students fill out lengthy questionnaires. I have some rather vivid recollections of the laboratory courses that I took as an undergraduate in which the reports and questionnaires occupied so much of our attention and required so much time that I am afraid most of us lost sight of the whole point of the experiment. These sessions were apt to be extremely boring and not only did we dread the approach of the laboratory, but also we were decidedly relieved to be set free at the conclusion of the period. It has always seemed to me that the laboratory period could be much more effectively terminated with an explanation by the instructor of the importance of the experiment and what it is intended to illustrate, followed by a discussion period in which the student may ask questions on the experiment itself, and the topic at hand. This, I believe keeps his attention focused on the exercise and I think he is apt to remember its features longer than if he had spent his time hurriedly looking through textbooks for answers to complete a questionnaire. Although it is not always possible, I try to run the laboratory experiments concurrently with the lecture work. This, I think, serves further to focus the students' attention on a single topic and thus, I hope, leave a more lasting impression.

It has always been my policy to encourage students to ask questions at any time, for the proper time to clarify a particular point is when the question is fresh in his mind. To ask him to hold his questions in abeyance until a later time is to discourage him from asking them at all. Thus, I am not averse to having prepared lectures interrupted for

brief discussions and I have yet to find that these impromptu sessions seriously interfere with the planned course work. I am not in agreement with those who feel that a certain amount of material must be covered in a given period and who consequently adhere to a hard and fast outline which does not permit any interruptions. The important thing in any teaching program is not the quantity of the material covered, but rather the clarity with which it is presented. A teacher can be sure of this only by encouraging questions from students and permitting the discussions that such questions frequently prompt. It is therefore my practice to permit discussion whenever and wherever it may be occasioned.

The most important aspect, however, of the discussion period is not so much one of time or place, but rather how it is conducted by the teacher. It has been my experience that at the beginning of each course there exists some sort of intangible barrier between the students and the instructor. This is evidenced by their reluctance to ask questions and by the difficulties which I, as the teacher, have in provoking any discussions. In short, these class periods are apt to be rather dull, and many times I have walked away from the classroom somewhat discouraged by what all indications point to as a complete lack of student interest. However, I have come to interpret this reaction, or lack of reaction on the part of the students as being part of a period in which they are sizing-up the instructor to determine just what sort of a person he is. I should point out that in most instances I have little classroom contact with the students prior to the time they take pharmacology as seniors, although because ours is a small school, I do have opportunities to become acquainted with many outside of the classroom. Nevertheless, there invariably exists this reluctance on their part to participate in any discussion during the initial meetings of the class. One of my first responsibilities, therefore, is to break down this barrier and this I try to accomplish by creating a friendly atmosphere in the classroom and laboratory and conducting the work on as informal a basis as is consistent with good discipline. I try to keep in mind that these people are adults and that they deserve to be treated with the consideration due an adult. After all, they are on the verge of graduating and will soon assume the responsibilities of earning a livelihood. In fact, some of them are already married and have the responsibilities of family and home. In any case, I think adult consideration and courtesy is in order and while this approach has backfired on some occasions, it has not happened often enough for me to change my attitude. Most people respond well to proper consideration and students are no exception. I do not mean to imply that they should be mollycoddled, because there is a vast difference between this and considerate treatment.

I would say that with the creation of the proper student-instructor relationship in the classroom, the next principle underlying the successful conduct of the discussion period is this – always give due consideration to any question seriously asked and above all avoid embarrassing the student who asks it. To me this is of paramount importance, for the surest way to kill any discussion is to reject a student's question as unworthy of consideration, or embarrass him for what may appear to the instructor to be a stupid question. I would venture to say that any student thus treated has asked his last question of that instructor. I am sure that we have all seen this sort of thing we can agree that the results are anything but good. Of course, an instructor is subject to all types of questions – some intelligent and some not so intelligent and some probably that are intended to put him "on the spot," or perhaps inject some humor into the situation. It may be a little difficult sometimes to recognize the intention of the questioner, but it seems to me that the safest rule to follow is that if there is an outside chance that the question has been seriously asked, it should be given a serious answer. I have in mind, too, those instances in which a serious question will provoke an outburst of laughter by the rest of the class. On these occasions, I try first of all to justify the question and relieve the embarrassment that the questioner is undoubtedly suffering. While a sense of humor is, of course, a necessary requisite of any instructor and will contribute to the friendly atmosphere if judiciously employed, it certainly should never be used at the expense of the student.

A third principle which I believe to be necessary to the proper conduct of the discussion period is the necessity for complete honesty and fairness in our teaching practices. This is an elementary principle of conduct and one which hardly requires any comment. However, I have in mind the practice, seemingly quite innocuous, of giving evasive answers to questions when in fact, the response should be a flat "I don't know." The temptation for us to do a little bluffing to prove that we are omniscient is understandable, but even though we may be able to disregard the dictates of our conscience on these occasions, it is well to remember that most students are not going to be satisfied with vague answers and half-truths and when they do find out that these are being given to them, and they surely will, then their faith in the individual will completely vanish. Of course, I am sure it is not necessary to add that the matter should not be dropped after the honest "I don't know" has been offered the student, but should be followed up with an attempt to find the proper answer. This can do much to raise the stature of the instructor and at the same time make him appear a little more human to the student.

In conclusion, it seems to me that the questions of where and when discussion sections are held are of relative unimportance, and emphasis should be placed on how they are conducted. The discussion period can serve a very useful purpose or it may fail miserably. Its success or failure is largely in the hands of the instructor.

DISCUSSION

Observations in regard to discussion type periods:

1. Students should be able to interrupt lecture at any time.
2. Teacher should never be facetious. There are no silly questions ! ! !

One man has instituted instead of 3 lectures per week, 2 lectures with one discussion group. He has 3 teaching fellows. The class is divided into fourths, and uses an individual room for each instructor, the classes

are rotated so that each group does not see the same instructor more than about twice per quarter. Prior to class, instructors go over questions and formulate key questions. The students then carry the discussion. This method brings out student weaknesses.

Q. Is the lecture plan designed to keep teachers in line or to let students know where they are going?

A: Both.

Q: Do you, in your graduate program have a course in human relations?

A: No.
At Pittsburgh U. there is a requirement that all graduate students have a course in human relations. This should be in everyone's program. The key to education is in the student instructor relationship.

Q: Have you considered having a discussion on the day following the lecture?

A: Start lecture with asking students if there is any questions on previous material. Also start with a brief review of preceding work.

Q: Who should do the discussing in the discussion group?

A: Both student and instructor. Discussions are designed, among other things, to teach student how to talk.

Q: How does one get small enough groups for discussion sections?

A: Take ½ lab section at beginning of lab hour and the other ½ at end of lab hour.

Q: In the morning the educators spoke of students who had been exposed to this type of education since they were freshmen. Would it be good to encourage discussion groups for all courses in pharmacy schools?

A: Yes. Students have been indoctrinated since 6th grade to give the type of responses we are trying to get away from.

Q: How is the mold of student study habits to be broken?

A: One must resort to methods to keep students in line.

Q: How should we realistically cope with the situation as it stands, e.g. students in pharmacy school vs. ideals set up?

A: Treat student with respect and he'll treat you likewise.

A: There is much to be gained in an informal student-teacher relationship.

A: Reading should be guided more closely.

Discussion of student attitude.

In the final analysis graduating or passing students should not be based solely upon what he has done in the lab or in examinations, but he should have passed certain requirements and be ready to undertake his profession. The student with the attitude of just getting the piece of paper (diploma) should not be passed or graduated. This may depopulate classrooms but it eliminates a hypocritical attitude.

SUMMARY

There will always be three main types of students—those that just want the "paper", those of average ability, and the exceptional student.

The real problem is the mental block. Students who take the attitude "I only want to know what I have to know to apply in retail pharmacy" only get by because teachers let them get by.

Until the boards of pharmacy and law enforcement officials "lift themselves by their boot straps" students will continue with this attitude.

1. It is agreed that quiz or discussion groups are of value in teaching.
2. Quiz or discussion groups reveal the areas where students are deficient.
3. It makes little difference whether discussion groups are formally scheduled, if opportunities are given for spontaneous questions and answers.

HOW I EVALUATE THE PROGRESS OF THE STUDENT IN PHARMACOLOGY

GUILFORD C. GROSS
South Dakota State College

The problem of evaluating a student's progress in pharmacology differs, of course, with the size of the class involved. The instructor of the small class has the advantage of closer contact with his students which puts him in a better position, perhaps, to utilize the subjective factors in his evaluation and reduces the emphasis that must otherwise be placed on the completely objective factors. My experience has been with small classes. At South Dakota State College this past year our class in pharmacology numbered 37. Last year we had thirty-two. It is our practice, at least with classes larger than thirty, to divide the group into two laboratory sections of approximately equal size. Thirty happens to be the convenient capacity for our pharmacology laboratory. Thus the groups with which we deal are small and can, for the most part, be easily handled by the instructor himself. It is not a difficult matter then to get to know the individual student fairly well and gain a rather accurate insight into the quality of his work. I should say that within a matter of six weeks to two months we have a good idea of what his capabilities are. By this I do not mean to imply that we classify the individual on the basis of his work early in the course, but nevertheless for the most part it has been my experience that the inferences drawn then serve as a fairly good index of what his future work in the course will be like. Of course there are exceptions to this, but by and large it seems to me to be true.

I suppose that many of us when assigning a final grade to a student like to do so or at least like to be able to say we do so as objectively as possible. We take all of the grades that he has accumulated during the quarter or semester, and after properly weighting them, determine an average and assign a letter grade on that basis. This would seem to have certain advantages and probably does. The most obvious perhaps is that there is a series of figures to substantiate the final grade. The simplest way of executing this method is to consider only those factors for which a numerical grade can be assigned at least with some degree of accuracy — that is examinations, notebooks, reports, and the like. The subjective factors go by the board. Some of us, perhaps, use the examination as

the sole means of evaluating a student's progress and assigning a final grade.

In any event and regardless of the methods we use, the one thing we are all seeking is the method which will most accurately reflect the position of the student.

Before entering into a discussion of my own current procedures, I must confess that I have probably revised my methods as often as anyone and I certainly will not be bold enough to say that I have a formula now that is any better than the next one.

In my own case the examination, interim and final has always constituted the most important single factor in evaluating a student's progress in pharmacology. A good examination will, in my estimation, give a rather accurate index of the student's knowledge of the material covered. My practice, at present, is to give frequent short examinations of the objective type such as multiple choice or completion or those which can be answered in a brief statement or two. By frequent I mean as often as once a week, and by short I mean an examination of about 10 or 15 minutes duration.

In an objective examination anywhere from 10 to 20 questions may be asked in this period of time. This procedure does not require any considerable sacrifice of class time and because of the frequency with which they are given the student is apt to keep up with his work better than if fewer examinations are given with longer intervals between them. In any event the students seem to like this procedure and for that matter, so do I. In addition to these interim exams, I like to give a final exam over the quarter's work. However, at the present time such an examination must be limited to time allotted a regular class period, i.e. 52 minutes, because the Institution has dispensed with the policy, at least temporarily. of scheduling final examination periods. This policy has been in force only during the past year and prior to that time a two hour examination period was allotted to each course of three or more credit hours. Personally I liked the older system better because I prefer to give final examinations of sufficient length to accurately test the student's knowledge of the quarter's work.

I have never made it a practice to give a fixed number of examinations during a quarter nor do I always assign equal weight to the interim examinations that I do give. Rather, I try to weight the examination according to the extent of coverage.

The relative weight assigned to the final examination depends too, on the total number of examinations given, but ordinarily when we were on the old system, that is two hour final examination periods, I usually considered it as representing one quarter to one third of the examination grade.

It might be well to inject here a word concerning my policy on cheating. At the beginning of the school year I make it emphatically clear to my classes that any proven case of cheating is punishable by failure in the course. That is a standing rule in all of my courses. Because of the small classes involved it is not difficult for a single instructor to proctor the examination, and while I cannot be certain, I think very little cheating goes on. I do not invoke this policy unless I am absolutely certain of my ground because I have seen some tragic results from unjustified accusations.

The examinations, interim and final, constitute the sum total of the objective factors that I use in evaluating a student. I do not require term papers, individual reports, or laboratory notebooks and I do not grade the brief laboratory reports that are required. Actually, as far as the laboratory work is concerned, the student does not receive a grade at all except as his interest, participation and general conduct influence my final evaluation of him.

I should like to explain my reasons for this attitude toward laboratory work. In the first place, I do not currently require detailed individual reports from students on their laboratory work, nor do I have them answer questionnaires concerning the experiment. I not only minimize the value that such reports have, but it seems to me they may divert attention from the experiment itself. I much prefer to conclude a period with an explanation or general discussion of the exercise rather than subject the student to the tedious task of answering a lot of questions which he is apt to forget anyway before he leaves the room.

Most of our experiments other than demonstrations are conducted in groups — a group consisting of four to six students, depending on the size of the section. Each group does the experiment as a unit and simply records the results. This is the only report required and obviously it would be somewhat difficult to grade. This is a practice that I have been following for a number of years. I think it tends to stimulate interest in the laboratory work and avoids the boredom which otherwise might result.

The laboratory does serve a useful purpose in evaluating a student because here, perhaps more so than in the classroom, the instructor can observe him closely and make observations of value in ascertaining his final grade. Here the subjective factors can be assessed and these I think serve an important role in the evaluation of the student.

When it comes to the final grade, I do consider the subjective factors and they become particularly important when the student is a borderline case. Then, my personal opinion of him will determine whether he gets the higher grade or the lower one. As a matter of fact, in assigning the final grade to any student, it is my practice to give him a tentative grade first based on the objective factors, that is, the examinations and then modify this grade according to my own personal opinion of him. I review each student individually and consider those factors in his favor as well as those not favorable to him. His tentative grade may be altered depending on the results of this review.

The most important single factor in subjective grading, to me, is the matter of interest in the work. This can be assessed in several ways. First and perhaps most important is his class and laboratory attendance. Obviously, any student who accumulates a large number of absences during the term cannot be much interested in the course work. This factor alone seems to me to be a rather reliable index in determining general interest and certainly it is one on which I place a great deal of emphasis. Naturally, one must differentiate between absences incurred for valid reasons and those due to lack of interest. In addition to this, the participation of the student in recitation and laboratory work is an important manifestation of his interest, and I find that this ties in rather closely with

his attendance. In small classes it is not a difficult thing to single out the more active students. In my experience there have always been a few students who, although they are regular in class and laboratory attendance, seem to be in a stuporous state and it is not difficult to identify these individuals, and in the final analysis they are penalized for this attitude. Naturally, I regard any lack of interest on the part of the students as being a reflection on my teaching. I think in pharmacology we have a subject that the students should find extremely interesting, and whether they do or not is a matter that is largely the responsibility of the instructor. We cannot always say that a student's lack of interest is completely the instructor's fault, of course, for there are always those cases in which it is an impossibility for anyone to arouse any enthusiasm.

The questioning mind is a decided asset in my evaluation of a student. If he accepts willingly only that material which I can present to him, and has no originality of thought or desire to investigate further on his own initiative, I feel that at best he is only a mediocre student. There are always those, too, who can write a good examination, yet make little or no effort to delve into the unexplained realms of the subject. One of our responsibilities as teachers is to seek out the individual with originality of thought and foster this ability. This, of course, will be important in our assessment of him.

Now, I am going to admit that only rarely do I fail a student in pharmacology. In the Division of Pharmacy, it is our practice to carry out a rather rigid screening program early in the student's academic career. Because we have a small student body, we as a faculty get to know the student fairly well after he has been with us a relatively short time. His aptitude for pharmacy is rather well demonstrated within the first two years. It is during this period that we do most of our "weeding out." Borderline students are discussed in faculty meetings and appropriate action taken. So by the time a student reaches his senior year and the course in pharmacology, he has, for the most part, demonstrated his ability, and his chances for success in the course are good, at least, as far as passing is concerned. I do not think this is an undesirable practice, and feel that it is decidedly unfair to allow an unqualified student to continue beyond the first or second year when it is obvious that he cannot centage-wise allotment of grades.

In assigning final grades to students in pharmacology or any of my courses it is not now, nor has it ever been my policy to use the curve system. As far as I am concerned, if all of the students in a given course merited it, they could all make A grades. I do not believe in penalizing any student because of the percentage-wise allotment of grades.

This last spring the faculty of the Division of Pharmacy at South Dakota State College adopted a grading schedule to be used by instructors as a guide in assigning grades. The purpose is to create some uniformity in grading practices among the several instructors. The schedule is this:

A = 93-100
B = 85-92
C = 73-84
D = 70-72
F = Below 70

Now this is intended to be a guide only. Of course, it takes into consideration only objective factors. As far as I am concerned, I try to follow the schedule as closely as possible, but I do modify it on the basis of subjective factors.

In summary I should like to say that in my opinion, the examination, properly given, is the most reliable tool for objectively evaluating a student's progress, and as I have mentioned, it is the only one of the objective factors that I use. The subjective factors may be advantageously employed to assess borderline students, and in a deeper evaluation of the student with reference to future success. Together, objective and subjective factors properly blended should result in a more accurate appraisal of the student's progress in pharmacology.

DISCUSSION

Q: What particular motive did your school have in doing away with finals?
A: I don't know.
Q: Does your institution have a comprehensive examination in the senior year?
A: No.
Q: If a student has a grade of F in class work, but an A in attitude what do you do about it?
A: Probably pass him.
Q: By your grading system if you give a tough examination and no one attained a 93 what would you do then?
A: Generally speaking I would give no A's.
Q: If one student has an 80 and another a 79, and 80 changes the letter grade, how can you justify drawing a line? (In the light of the AM talk when he said there is always at least a plus or minus 3 point differential (Standard deviation, etc.)
A: A line must be drawn some place, if you desire to convert numerical grades to letter grades. It is difficult for a teacher to give a student a B for an 89 and an A for 90.
A: I use the following method: I give a very tough final, I then list the grades in numerical order and use the natural breaks to divide the grades. There is no set percentage for each group, just where the natural breaks occur. The students know that if they want to be sure of an A they have to get an A on the final, the rest is gravy.
Q: How many must you have in a class? Do you have to have a definite number so that you may adopt a philosophy of using a curve?
A: By the use of Z scores you can evaluate any number of students on a "curve".

$$Z = 10\left[\frac{X - M}{S.D.}\right] - 50$$

X is score
M is mean
S.D. is standard deviation

Q: (addressed to group). Do you fail seniors?
A: Seniors should be able to pass, although a couple have been held over.
A: The time for weeding out is in the sophomore year.

Q: What is the general policy when you construct an examination? Do you go to the first year's file and look over questions, or do you go at it cold?

A: Majority of those present go at it cold.

Q: How do you avoid absences before a holiday? We tried to institute a system of rewarding students who attended rather than penalize those who were absent. This system was not approved at a faculty meeting.

A: We once had a system, but have none now. This was, penalties for absences either against the accumulated grade points or against the credits, whichever was greater. It is now done strictly on an individual basis, except if the student is ill, and when this occurs, we get a note from the health service.

Q: You give a subjective grade that includes attendance. How many times could I be absent and still get an A?

A: I would not care to state a figure.

A: If a student attends class or if he just sits there he's gained something and should receive credit for it, and those that stay away even though they may go to the library are missing something that goes on in class. Therefore they should not get the same credit as those who came to class.

A: It is important to note that in small groups as there are in my school absence is not a major problem.

Q: What do you do when a student misses an examination?

A: If for a valid reason he has the option of taking a make-up or just omitting.

Discussion on attendance:

I can't agree with the facts stated about attendance. I don't think it makes a "damn" bit of difference how the student gets the material as long as he gets it.

Why not, then, dispense with classes? There are all types of students; some actually must have the classwork.

It seems to me that the ones who skip classes are those that need it most.

In the fall I lay down the conditions under which I conduct my course. One of the things I tell the students is that I don't care if they never come to class, that it is their responsibility to get the material. And if the student can meet the standards of the class, honestly, what is the difference how he does it?

Closing comment: "I hope that we are not afraid that students will learn more if they stay away than if they come to class."

Pharmacognosy Section

MONDAY DISCUSSION SECTION

R. DENO, *Presiding*

The objectives of the afternoon discussion sections is to get active participation of all members. This afternoon we will divide the section into four groups of six to seven. Group one to discuss Objectives of the Course in Pharmacognosy, lead by W. R. Brewer, Group two to discuss Course Planning lead by H. Hoch, Group three to discuss Lesson Planning, lead by W. R. Byrum and Group four to discuss Language and Learning in Teaching, lead by R. Deno.

Each group will consider its topic for one-half hour, and then report to the group as a whole its considerations and conclusions.

Report of Group 1.

Objectives of the Course in Pharmacognosy

W. R. Brewer reporting

1. The range or the scope of the course in the pharmacy curriculum. It was felt that this point was adequately covered by the seminar of last year.

a. Factors delineating the scope. This is dependent upon the purposes and objectives of the course and also upon the relationship with other courses in the professional curriculum and with the preparation that the student has prior to taking the course in pharmacognosy.

b. What to accomplish?

1.) How to establish the objectives? Noted that there is a great deal of information available in the literature on how to establish objectives.

2.) The value to the instructor and the value to the other faculty members and the value to the student was touched upon and the group followed in line with the thinking of the general educators that the objectives expressed by the instructor should be very broad and challenging and the details should be left to the instructor himself.

The group reached the following concise definition of the objectives of the instructor in pharmacognosy: To impart to the student an appreciation of crude drugs and their products and their integration with other information in the professional curriculum to the end that the pharmacist is a truly professional individual with relation to the subject matter of pharmacognosy and capable of meeting all future problems as they arise.

(Comment from floor) Would our objectives be broader in scope if, rather than crude drugs, we use the term cell, that is to say the cell as a producing unit?

OBJECTIVES OF THE COURSE IN PHARMACOGNOSY

WILLIS R. BREWER

University of Arizona

1. To promote the understanding that pharmacognosy is an applied pharmaceutical science dealing with the biological, biochemical and economic features of natural drugs and their constituents.
2. To emphasize the importance of dynamic physiological and biochemical processes in the formation of active medicinal constituents in plants and animals, the sources of natural drugs.
3. To develop an appreciation of the relationship of the natural drugs and their constituents to other pharmaceuticals such as the galenical preparations and synthetic drugs.
4. To integrate the study of natural drug products with the subject matter of other professional courses. (Ex.: Integrate with dispensing pharmacy by presentation of incompatibility potential of active and inactive constituents of crude drugs.)
5. To develop familiarity with, and intelligent usage of, scientific terminology, reagents, microscopes and other tools and techniques related to natural drug products.
6. To stimulate an understanding of the principles involved in the production processes of cultivation, identification, selection, breeding, collection and curing; in the refinement processes of evaluation, milling and extraction; and in the commercial practices of distribution and marketing as related to natural drugs.
7. To illuminate the ethical and moral aspects of dealing in certain natural drugs and their constituents and present those technical aspects upon which are based the needs for legal control of traffic under federal and state laws.
8. To provide knowledge applicable to the solution of public health problems with specific information on such substances as insecticides, fungicides, herbicides and rodenticides used in control of public health menaces.
9. To explain the purpose for, and the method of interpretation of, each section of the typical official monograph for natural drugs.
10. To acquaint future pharmacists with crude drugs and constituents with which they may be expected to deal in professional practice and qualify them to provide the other health professions with accurate, objective and scientific information concerning them.

Q: Do you hand out these objectives to the students at the beginning of the course?

A: Yes, at the very beginning, and then I discuss

them with the students.

Q: Do you think they grasp what each one of them means? It strikes me in reading them over that they are not in terms which will have too much meaning to a student just coming into the course.

A: It's true that they are in terms which require some discussion.

Q: Do you make any effort to find out whether they understand all of these objectives?

A: Yes, I would say that through discussion we find out.

Comment from floor. It was felt that more simply stated objectives would be of more value to the student.

Q: To what extent should prescription specialties be included in the undergraduate course in pharmacognosy?

A: Inclusion of prescription specialties, where they apply to natural drugs and drug products would seem to complete the entire picture for a given drug. That is, beginning with growth and production and on through, the story ends with the finished product as it is sold.

Report of Group 2. Course Planning.
H. Hoch reporting

The group agreed that local situations modify any planning of a course. The prerequisites to the course, the level of achievement of the students before they come into pharmacognosy naturally will modify the course plan.

The discussion group agreed that it did not matter much which type of classification one used in planning the course. Local situations will certainly govern the choice.

The question of what drugs should be included is difficult. Certainly the choice is governed by the importance of a drug with regard to its use and this will vary with the locality.

The course in pharmacognosy should tie-in with other courses in the pharmaceutical curriculum, such as pharmaceutical chemistry and dispensing pharmacy.

Unknowns, it was felt, should be included in the course because of stimulation of student interest.

The question of crude drug recognition was raised. In general, most oppose requiring drug recognition except when state board examinations still include it. Some maintained that crude drug recognition was a visual aid for the student in more fully appreciating the drug.

It was generally felt that crude drug displays should be available to the student, though he should not be required to identify them.

Q: Why, in the course outline offered, were such topics such as drug conservation and history placed where they were?

A: For convenience.

Comment. Would it not be more suitable to cover such a topic as history throughout the course rather than confining it to a given lecture?

Report of Group 3. Lesson Planning
W. R. Byrum reporting

How to Plan the Subject and the Unit
(a) Relate to paper on "Learning Process"
(b) Daily preparation

LESSON PLANNING IN PHARMACOGNOSY

W. R. Byrum
Howard College

In planning an approach to the presentation of the individual drugs in pharmacognosy, one should, of course, keep in mind the objectives to be accomplished. These were ably stated by Edward P. Claus at the Teachers' Seminar on Pharmacognosy as, "The course in pharmacognosy equips the pharmacy student with serviceable as well as reserve information concerning certain natural drugs and their derivatives. The student recognizes the natural, chemical, and therapeutic relationships of these drugs and derivatives and he realizes that they are dependent upon biosynthetic metabolism of living plants and animals. He understands that modern laboratory ingenuity is based on the attempt to synthesize all natural products and to duplicate them, either by exact chemical composition or by similar pharmacological properties, in order to insure their constant availability to the medical profession. Through his learning in pharmacognosy he can grasp more easily certain portions of his course in pharmacology, drug assay, pharmaceutical chemistry, galenical pharmacy, dispensing pharmacy, and public health. He is able to read intelligently and interpret correctly the official compendia and the standard text and reference books in his field. In short, pharmacognosy should serve to inculcate an appreciation of the role plants and animals play in the fields of medicine and pharmacy, and also to equip him with specific data and background information that he will use in dealing with his professional associates."

Lesson planning for effective teaching involves many factors. The teacher must not only know the facts of his subject, but he must know the facts which will be meaningful to his pupils and how to organize and present the lesson in a psychological as well as a logical fashion.

Effective lesson planning is dependent upon a knowledge of the psychology of learning and basic educational principles. The pharmacognosy teacher must have an interest in and an enthusiasm for his subject; he must know the relationship and relate his subject to the total curriculum; he must know how and when to use each of the several techniques of teaching; and deliberate planning and presentation must be followed by an objective analysis of results.

The suggested outline which follows is for drugs of primary importance. Drugs of less importance (on the basis of pharmaceutical and therapeutic usefulness) are covered less completely.

The outline is presented to serve as a point of departure in the discussion dealing with lesson planning and not as a model outline.

SUGGESTED OUTLINE FOR DRUGS OF PRIMARY IMPORTANCE

Scientific and common nomenclature
  Derivations and sources
History
  Early uses
  Introduction into medical practice
  Introduction into official compendia
Geographic distribution, collection of drug parts, com-

merce, and commercial production with reference to climatic and other environmental conditions.
Definition, taxonomic or zoological relationships, and important characteristics of family
Official rubric
Storage requirement (preservation and protection)
Macroscopic description of official crude drug and growing organism
Microscopic characteristics of cell constituents, cells, tissues, organs, and organ aggregates
Official assay
Microchemical and macrochemical tests
Detection of adulterants
Constituents of medicinal and pharmaceutical value
    Name and structure of active principles
    Distribution in organism
    Method of extraction
    Definition and review of the physical and chemical properties of chemical group to which active constituents belong including incompatibilities
    Biosynthetic processes (biogenesis) involved
    Significance of constituent in biological processes of organism in which found
    Relationship of chemical structure and physiological action
    Synthesis of active constituent
    Biochemical relationships
    Chemical and physiological relationship to synthetic products
    Chemical reactions used for identity and purity
General methods for evaluation of pharmacologic and therapeutic activity
Official preparations
    Uses (pharmaceutical and therapeutic) and doses
Proprietaries containing official preparations
    Advantages of various commonly used combinations
Synthetic substitutes
    Advantages
    Chemical relationship to natural product
Reference material

Supplementary Information Through Student Participation

A. Popular articles from magazines and other sources. Students are urged to read and bring to class popular articles dealing with the current discussion. Student interest rewards the instructor who compiles articles of this nature, cites them as references, uses them in assignments for reports, and selects a few for review in class.
B. Students are urged to bring to class crude drugs, living specimens, "patent medicines," prescription specialties, and other items related to pharmacognosy which are not available at school.
C. Growing of medicinal plants as ornamentals at home.
D. Collection of indigenous medicinal plants.
E. Encourage students who have hobbies to give them a pharmacognostic slant, when possible. One student whose hobby is photography presented the school with a number of Kodachrome transparencies of indigenous medicinal plants – complete with a viewing case.
F. Reports (associated with personal interests, experiences, or knowledge).
G. Student demonstrations.
H. Group discussions.
I. Field trips.
J. Designing and installing window and other types of displays related to pharmacognosy.
K. Work and study in drug garden.

Laboratory

A. Morphological examination.
B. Histologic examination.
C. Identity tests (crude drugs).
D. Microchemical tests (derivatives).
E. Study of preparations (official and commercial).

In discussing the Drugs of Primary Importance, the question was raised as to whether you would consistently use all of this material for discussing each drug?

The group agreed that the over-all purpose in planning a lesson is to insure that each lesson is well taught. Planning the lesson would insure the wise selection of material and the elimination of unimportant details, it would make certain that proper consideration is given to each part of the lesson, it would aid the instructor in presenting the material in the proper sequence for efficient learning, it would provide an outline of teaching procedures, it would serve as a means of relating each lesson to the objectives of the whole course and lastly, it would give the inexperienced instructor a feeling of self confidence.

In discussing the characteristics of a good lesson, the group decided that it should have unity, that each lesson should be a unified segment of instruction, that one lesson is concerned with one objective and all teaching materials and procedures are selected to attain this objective.

Each lesson should contain some new material, related however to subjects already presented and a short review of the earlier lessons is often necessary.

Each lesson should be reasonable in scope. Students can master only a few principles at one time. If too much material is presented it causes too much confusion; if too little is presented, there is a waste of time.

Every well planned lesson has practicality and a very definite relationship to the overall curriculum. Each lesson should be taught so that this is evident.

The group felt that the examination should always be used as an instrument of learning as well as testing.

Comment. Would it not be better to stress principles and components rather than requiring a student to know everything about every drug as the outline suggests. Is it not better to treat the drug as the synthesizing unit of the product, is it not the product that is important?

Opposing, it was felt that we must ultimately come to the drug itself for study, but that possibly a combination of the two methods would be the best approach to teaching.

Comment. In the method of teaching principles, you tend to develop a logical type of organization. The other approach tends to be encyclopedic, teaching one drug after another, everything about the drug. Pedagogically, the encyclopedic approach tends to emphasize rote memory, while the approach through principles approaches the material logically and tends

to classify things logically.

Report of Group 4. Language in Learning and Teaching.

R. Deno Reporting

The group discussed this subject mainly from the point of view of terminology; that is terms that are peculiar to pharmacognosy or are first encountered in pharmacognosy. The group discussed this under three headings: The extent or scope of terminology that should be required of students, the methods of emphasizing this objective of the course and finally the methods of determining whether the terms had been comprehended.

With regard to the extent of terminology the group felt that the official compendia should be a source of terminology but by no means the only source. Additional literature, product pamphlets, N.N.R., etc.

It was felt that terms should not be isolated from the course, but used and taught throughout. Recitation and reading of scientific literature aloud might well be used to emphasize proper pronunciation. It was also felt that roots of words which are repetitive should be emphasized as an economical means of recognition of several terms and as a means of tying up terms in pharmacognosy with terms of related fields.

It was agreed that the student should not be required to memorize roots, prefixes, suffixes, etc., but that the emphasis should be on the importance of understanding the meaning of scientific terms.

With regard to testing procedures, several felt that multiple choice questions would be useful. Others expressed the idea that the word be used in a paragraph, rather than isolated, and ask the student to explain the meaning of the paragraph.

It was felt that terms describing uses of drugs must often be included.

TUESDAY SESSION

Rational Learning in Pharmacognosy
L. D. Hiner presiding

With respect to rational learning in pharmacognosy, I believe my path would be struck along this line; memorizing with a purpose plus the rational use of logic and reasoning.

My conclusions come from experience and observation, in the main, because I do not consider myself to be a trained educator.

Any successful course of study must have an organized plan of presentation and pharmacognosy is no exception. As a matter of fact the great number of things in this subject which have to be memorized and/or put into a system in the students mind probably requires more organization than usual. On the other hand, teachers of pharmacognosy have two advantages, and I would ask you to interpret this in a liberal fashion, over teachers of some of the other subjects in the pharmacy curriculum. First, pharmacognosy in the main is easily understandable. In the second place, pharmacognosy is not as prone to numerous and rapid changes as are some of the other studies in the field of pharmacy. This situation is conducive to a high degree of organization of course material with resulting benefits to the student. And this morning we learned that organized material is more easily understood and retained. But take care lest you become accustomed to leaning too heavily on this organization material. It's much more effective for the instructor to walk in and face the class with his guide of course and then start in and deliver his lecture. Talk intimately to your students; invite them to go with you on this adventure; and only follow your organized notes as you need to.

The situation of high organization in pharmacognosy doubtless accounts for the course-organization debates which have centered around botanical versus morphological versus therapeutic versus chemical versus alphabetical systems of classification of drugs for student consumption. Everybody has his pet organization scheme, and I'd like to see them keep it, frankly.

Irrespective of the order in which the drugs are finally offered the proper introduction to the course in pharmacognosy is, in my mind, the most important thing to the student's attitude. From experience, I have found that improper orientation into courses is the one chief cause of failure, according to reports from students summoned to my office following the mid-term reports. Since this is a seminar on how to teach, it behooves us to take cognizance of these things, and act accordingly. When we have accomplished the proper introduction to the course in pharmacognosy we will turn our attention to the art of teaching about the various drugs.

In introducing the new student to the course in pharmacognosy, I like to explain the facts of pharmacognosy as contrasted to the memorization of a definition of the subject.

The horror of the teaching profession is the pharmacognosy man who never had, or has lost the sense of communion with his students. Then he foists onto them only definitions and facts unmindful of the personal enthusiasm it takes to interest and motivate his students. At the first meeting of the class I like to visit with the students rather generally about drugs derived from natural sources, and mention is made of where they must travel to get some of these, and how some of them have to be collected and prepared for market. The text is introduced at this first meeting to orient them into pharmacognosy and its author is dealt with in some detail so that the students feel that they know him too. Unless the author of the textbook in pharmacognosy becomes an authority, such as he is, and a respected hero to the students for his many accomplishments, and an altogether loveable character, I feel that I haven't properly introduced him. This, it seems to me, is the rational introduction to the wonderful subject of pharmacognosy: it should help to overcome apprehension and resistance to learning and sends the student away eager to return another day. Loathsome to me is the instructor who greets his class sardonically, saying how difficult it's going to be and how many must fail in order to preserve his grade curve.

Next the teacher must now contemplate the launching of his new class on its didactic venture into the realm of drugs.

An approach based on discovering the answers to a series of logical questions about the drugs seems a logical course to chart. As this logic unfolds the details of the course structure become readily apparent to the students. *First,* (I must remind you what I consider minimum information that the student should have when he has finished the course). it is apparent one must know the proper official name of the drug about which he is to learn, and more frequently than not it is easy at that time to associate with that title the proper position the drug occupies in our official books. Again I would caution you about over-emphasizing U.S.P. and under-emphasizing the N.F.

Second, since Latin names still constitute an essential item in pharmacists art, oral and written communication, they become a professional asset, generally, and occasionally a state board necessity.

Third, how convenient it would be if everyone would be considerate enough to call for drugs by their proper English or Latin titles. But alas, it is not true, so the next logical question to ask of the pharmacist invariably is "what about this drug yellow root?" The common names of drugs are thus a must in the order of events. More often than not there are intriguing tales that lie back of these nick-names to make them fascinating to hear and interesting to remember.

Next in order of inquiry might very well be a request as to what kind of a plant does the drug come from. And at this point I like to review the fundamentals of systematic botany in this way. I like to discuss the great divisions of the plant kingdom in relation to the typical types of plants that are found in each and the relative importance of each division as a source of crude drugs or as a source of the need for crude drugs. At this point also as a visual aid I like to introduce several texts on taxonomy in an attempt to impress the group with the significance of the botanical origin. Herbarium specimens exhibited at this time are effective too.

I used to teach official definitions but this has been discontinued in favor of emphasizing the parts of the official definition; official name, parts used, active constituents.

Rationally then the next question would be if these drugs contain active constituents, how much is present. Methods of measuring them quantitatively lead to many discussions of assay methods, biological and chemical.

We are up to the uses of drugs. In this matter, I do not ask my students to sit down at the beginning of the course and memorize a list of drug uses. In the first place the terminology is so new to them they scarcely understand many of the definitions any way. And in the second place I have found that if you discuss the uses briefly with them they soon pick them up one after the other. When you teach uses of drugs, prepare the way for the pharmacology colleague who later will build on your foundation the final chapter on how drugs act and how they are used in therapeutics.

Reasonably now, if drugs are going to be administered, it behooves the class to immediately give attention to the matter of dosage. There is no substitute for knowing dosage. This is one of those rote memory affairs. Orienting a class to posology should include an understanding of the terms average or usual dose, minimum and maximum dose, toxic and fatal dose, and range of doses.

With the discontinuance of the use of crude drugs as such, the student of pharmacognosy should commit to memory some of the preferred preparations of the drug. This helps to associate pharmacognosy with pharmacy.

And finally, the general comments. This fundamental information I feel the student should have, whether it's doled out in a single package or is accumulated along the learned by-ways in separate units to be associated later in the student's rational learning process. Under the general comments the instructor has a chance to talk about the history and romance of these drugs, their habitats, collection and preparation for market, dispensing cautions and the like in accordance with what it takes to hold the interest of the student. Student participation occurs at this point too, and the personal experiences of the instructor are appropos. Good, general education and wide experience in travel are the best tools that the instructor has at this point. Visual aids are introduced here and at this point comes in the plant and the drug itself, its constituents and company products.

There will be many modifications and alterations of the plans for teaching pharmacognosy, but above all it is commended to each of you that to properly teach this subject, you must love and respect it. The students will sense your enthusiasm and their own interest will mount.

Strive for communion with your class and by your personal attitude toward the students and the subject, seek to unite them. Then I think you will reap the compensation of teaching the students who stop by as they leave your class and speak softly so their classmates won't hear them say, "Professor, today I sure liked your teaching".

Discussion

In general, the group felt that it was no longer necessary to stress Latin titles, since the compendia are now listing the Latin title as a synonym.

A general discussion as to how classes were taught in pharmacognosy followed. Most instructors use the lecture method, primarily because of large classes. In some schools, a combination of lecture and recitation is used. Several instructors have assigned papers or topics to students and require each student to deliver that paper before the entire class. Still others have tried the seminar method along with lecture.

WEDNESDAY SESSION

Methods of Demonstration and Laboratory Instruction in Pharmacognosy

DISCUSSION LEADER

H. W. YOUNGKEN, JR.

Topics:

Carbohydrate Drugs—R. W. Vander Wyk
Glycosides—F. L. Mercer

Alkaloids—H. W. Youngken, Jr.
Antibiotics—H. E. Bailey

METHODS OF DEMONSTRATION AND LABORATORY INSTRUCTION IN PHARMACOGNOSY

H. W. Youngken, Jr.
University of Washington

Much has already been said by a number of pharmacognosy teachers (1-10) concerning methods for conducting the laboratory, its objectives, how the subject matter can best be arranged, the ideology of both subject matter and teacher, the credit problem, and necessary equipment. It may also be recalled (11) that a recent Pharmaceutical Survey study committee has proposed that the laboratory be correlated with the lecture periods in pharmacognosy and that 192 clock hours be devoted to it. References to the currently published literature on these aspects of pharmacognosy are well worth reviewing in planning curriculum revisions for the subject.

Since this session of the Teachers Seminar is devoted to the pedagogy — the teaching methods — of the laboratory, our immediate task is to discuss certain phases of the "how" of teaching pharmacognosy laboratory.

After listening to so many experts who have thus far presented to the Seminar well founded ideas on educational methods, including this morning's general discussion of the laboratory, I feel somewhat humble in attempting to supplement what has already been said. But I am certain that the contributors to this part of the program and in fact everyone present this afternoon will have at least one bit of wisdom which may be used to improve existing methods for teaching phases of pharmacognosy laboratory.

In planning the program, your committee has been mindful of the problems in pharmacognosy and of the broad policies that can be expressed for teaching the subject. We have been conscious of the omnipresent desire of many teachers to integrate whatever is given in the laboratory with the lecture and with other courses in the curriculum. Furthermore, we agree with others that the teaching methods employed should liberate the student from whatever fear complex or indifferent attitudes he or she may show to pharmacognosy. It would be ridiculous for me to state that such complexes and/or attitudes do not exist in respect to the laboratory of the general course. One of the foremost examples of "psychoses" herein is the student's approach to the use of the microscope and to microchemical methods for examining vegetable drug components. These attitudes are not unlike student adversions for handling blood and animal dissection in still other sciences in biology.

In regard to integration, liberation and how to teach, I am reminded of an entertaining account of an educator's philosophy of the teacher recently described in the "American Scientist."* This concerns a night-time vision which the author experienced after reading the "New Yorker" magazine. Lagemann, in his dream, sought as a college dean to quiz a Professor X, an authority in the new general education courses in science on teachers' methods. The question-answer period went somewhat as follow:

Q: What must the demonstrator provide?
A: A masterly performance. He must captivate his class, bring down the house, steal the show.
Q: What must the teacher avoid?
A: He must avoid being dull, forbidding, muddled, boring, flustered, disconcerted, mediocre, indirect, verbose, given to long pauses, tedious, listless, dreary.
Q: Well, that gives us the idea. Now then, Professor,
A: Don't try to stop me. You asked, you know. May I continue?
Q: By all means.
A: Where was I when interrupted?
Q: Dreary.
A: Oh yes, dreary. Also uninspired, run-of-the-mill, inept, obtuse, and fossilized.
Q: Now when you put on a show.
A: I beg your pardon. We scientists never put on a show. We teach with consummate artistry. A picture is worth a thousand words. Seeing is believing.
Q: Otherwise the "laboratory" would be pedestrian and thin. It would drag?
A: That's the idea. Bravo.
Q: Thank you. Uh-your scientific colleague, Professor Y, says that integration and liberation are loaded words. He doesn't understand them. You do not speak the same language.
A: Well?
Q: He says your words are vague, generalized, and emotion-packed.
A: Yes?
Q: Yes, indeed. He says he is teaching rigorous thinking, critical and exact thinking, that is.
A: Oh?
Q: And his students carry such rational thinking over into their everyday life.
A: Really?
Q: His students receive a disciplining of the mind.
A: You don't say.
Q: Yes, and they are taught *the* scientific method.
A: My colleague doesn't like loaded words, eh? Now see here.
Q: Well, I'm afraid that's all the time we have. Faculty meeting coming up, you know."

*Lagemann, R. L., "General Education Courses in Science," American Scientist 42: 296-298 (1954)

I am sure that there are Professors X and Y among pharmacognosy teachers and that the sum total of their differences, loaded words or not, results in a code for good and bad teaching. The time has come for a critical appraisal of our laboratory methods — an examination of certain techniques of the laboratory demonstrations and exercises — action for improvement rather than a play on words!

In order, then, to turn from generalities to the "how" of teaching pharmacognosy laboratory, I suggest that we select certain rather specific examples by which we demonstrate or direct student exercises and

that we analyze these critically. An exchange of ideas might lead to startling improvement in laboratory teaching. Although important from the standpoint of integration and support of the lecture material, which after all is the first objective, the subject matter, as it is to be employed by the contributors today, should be relegated to a secondary importance. Nevertheless, for the convenience of the program the discussion of teaching methods might commence with the use of certain specific subject matter from four broad areas of the instruction in pharmacognosy. Teaching methods employed by four widely separated laboratories from the subject matter of carbohydrate, glycoside, alkaloid, and antibiotic drugs, and/or other related materials can follow in that order. The purpose of each demonstration should be to make available laboratory methods which, in several instances might be applicable to other subject matter or to the operation of the laboratory as a whole. The technique which is to be employed for this purpose will provide for slide projection during which methods used will have been prepared in many cases in the laboratory of the contributor. Following the demonstrations, everyone in attendance will be invited to comment on the methods shown and to present or discuss methods of his or her laboratory as time permits.

The general objectives of the laboratory for which teaching methods should in some manner be developed can be summarized as follows:

1. To correlate the subject matter of the lecture so that there exists a visual transformation of that which has been said and read with that which can be observed. This is perceptual learning.

2. To develop in the student a scientific reasoning and/or imagination. We can refer to this as perception in the laboratory.

3. To afford the student an opportunity to learn a reasonable number of techniques. This objective, when fulfilled, not only aids in liberating the student from his "fear" complex concerning laboratory manipulations, but often serves as a measurement of his learning accomplishments.

The problems before us are *how* to meet these objectives as effectively as possible; for example, how to select from a wide source of material that which is most useful for teaching a point or demonstrating a principle; how to gain student interest; how to evaluate student participation; what to expect in the way of the laboratory notebook; the best method for motor perceptual learning in pharmacognosy laboratory; the best method by which students can gain confidence in the use of laboratory equipment; etc. A general discussion of these problems, or others of mutual interest, is now in order.

REFERENCES

1. Wirth, E. H. – American J. Pharm., Ed. 4 584, (1940)
2. Ahlquist, R. P 7 350, (1943)
3. Gramling, L. G. 6 100, (1942)
4. Bienfang, R. 3 206, (1939)
5. Youngken, H. W. 3 209, (1939)
6. Albers, C. C.–Teachers' Seminar on Pharmacognosy and Related Subjects – University of Utah, College of Pharmacy. Section E – Laboratory Instruction in Pharmacognosy (1) 1954
7. Reese, J. A. (2)
8. Gibson, M. R. (3)
9. Hoch, J. H. (4)
10. Youngken, H. W. (5)
11. Blauch, L. Webster, G., "The Pharmaceutical Curriculum," American Council of Education, Washington, D. C. 115, (1952)

LABORATORY DEMONSTRATIONS OF TEACHING METHODS

1. The Area of Carbohydrates–
   R. W. VanderWyk
   Massachusetts College of Pharmacy
2. The Area of Glycosides–
   F. L. Mercer
   St. Louis College of Pharmacy,
3. The Area of Alkaloids–
   H. W. Youngken, Jr.
   College of Pharmacy
   University of Washington.
4. The Area of Antibiotics–
   H. E. Bailey
   Wayne University College of Pharmacy

DRUGS CONTAINING CARBOHYDRATES AND THEIR DERIVATIVES

I The Area of Carbohydrates

RAYMOND W. VANDER WYK
Massachusetts College of Pharmacy

Since the carbohydrates for the most part are physiologically inactive, there often exists a temptation to pass over them lightly in our studies. Yet the carbohydrates do occupy a very important place in pharmacy and in medicine as witness the vast amount of soluble sugars used for intravenous feedings in our hospitals, the number of bulk producing laxatives on the market containing mucilages, and the number of preparations using carbohydrates or their derivatives as suspending agents.

Laboratory procedures involving a study of the carbohydrates should, therefore, stress those physical and chemical properties which best demonstrate their usefulness in medicine, i.e. solubility, suspending properties, and swelling properties. Identification and purity tests should, of course, be demonstrated where possible.

Following is a summary of how carbohydrates may be classified for study, together with a list of the more common ones in use today.

I MONOSACCHARIDES

Dextrose	Honey
Liquid Glucose	Sorbus
Triticum	Malt
Manna	

II DISACCHARIDES

Sucrose	Lactose

III POLYSACCHARIDES

Starches	Methyl Cellulose
Dextrins	Carboxymethyl Cellulose
Cotton	Oxidized Cellulose
Inulin	

IV DERIVED CARBOHYDRATES

A. GUMS

Sodium Alginate	Tragacanth
Fucus	Karaya
Acacia	Sterculia
Ghatti	

B. MUCILAGES

Althea Leaves	Fenugreek
Althea Root	Linseed
Chondrus	Mullein
Agar	Psyllium Seed
Elm	Farfara
Quince Seed	Salep

C. PECTINS

Pectin

D. SUGAR ALCOHOL

Manna

With the aid of demonstration projection slides I shall select several carbohydrates from the above list and discuss some laboratory procedures which can be carried out in any pharmacognosy laboratory.

I. MANNA

Manna can be used to demonstrate a drug containing a soluble carbohydrate material, and how this material can be extracted and identified.

Slide 1. Prescription specialties containing mannitol hexanitrate

Slide 2. 0.1 Gm. of crude drug shaken with 1.0 cc water in microtest tube.

Slide 3. Microfiltration of solution on to a clean glass slide and subsequent crystallization of material from solution.

4. Photomicrograph of mannitol crystals.

II. THE STARCHES

Any of the commonly available commercial starches can be used to demonstrate an insoluble carbohydrate. Several starches can be selected and mixed to form a composite unknown sample. The student is asked to examine his sample microscopically in water and in iodine water, and to identify each type of starch in the sample. The student should be given a larger number of known starch samples with which to make comparisons.

Slide 1. Photomicrograph of water mount of a mixture of three types of starches.

Slide 2. Same in iodine water mount.

III. METHYL CELLULOSE

Useful to demonstrate a soluble polysaccharide derivative which is used because of its suspending properties and viscosity in solution.

Slide 1. Display of various physical forms together with a number of pharmaceutical preparations.

Slide 2. Demonstration of solutions in water of different viscosity types. By inverting the test tubes the student can ascertain the different degrees of viscosity. This slide also points out that the product is more readily soluble in cold water than in hot.

IV. PSYLLIUM SEEDS

Useful to demonstrate the presence of mucilage in seeds and how the mucilage swells in contact with water, and therefore acts as a bulk laxative.

Slide 1. Display of various commercial varieties of psyllium seeds together with the nutlets of *Lallemantia Royleana,* its chief adulterant. Also shows a number of commercial preparations.

Slide 2. Demonstration of the N.F. mucilage swelling factor test.

Slide 3. Shows technic for cutting cross section of seed.

Slide 4. Photomicrograph of a cross section of psyllium seed mounted in alcohol to show its insolubility in this solvent.

Slide 5. Photomicrograph of same after addition of water beneath cover glass. Notice the bursting epidermal cells due to the swelling property of the mucilage.

Slide 6. Photomicrograph of cross section of nutlet of *Lallemantia Royleana* (Fam. Labiateae) mounted in water. The excessive amounts of mucilage produce finger-like projections which cause the nutlets to become entangled together.

Discussion

Carbohydrate Drugs

Q: Are your students permitted to refer to the U.S.P. and the N.F. during the laboratory?

A: Yes.

Q: What laboratory exercise do your students do with chondrus?

A: National Formulary Identification.

Q: Do you include hesperidin with the carbohydrates?

A: No.

Q: Is the ocularmicrometer used in your laboratory for measuring starch grains or other tissue elements?

A: We teach a separate course in plant anatomy where this is covered.

LABORATORY INSTRUCTION IN PHARMACOGNOSY

II The Area of Glycosides

FRANK L. MERCER

St. Louis College of Pharmacy and Allied Sciences

Pharmacognosy is an important constituent of the Pharmacy curriculum and provides foundation information for instruction in such courses as dispensing pharmacy and pharmacology. This foundation information should include a knowledge of the physical and chemical properties of crude drug extractives (glycosides, alkaloids, etc.), methods by which products of natural origin are evaluated and the pharmaceutical applications of natural products. It is apparent from a consideration of these objectives that laboratory instruction in pharmacognosy is essential.

Hours and Credits

There is a difference of opinion as to the amount of time that should be devoted to laboratory work in pharmacognosy. In a recent survey (65 colleges of pharmacy) by the author it was found that laboratory instruction in pharmacognosy varied from zero to four credit hours. Four schools offered four credit hours and five schools did not offer any laboratory instruction. Forty five per cent of the schools offered two credit hours. The recent Pharmaceutical Survey study committee (1) suggest four credit hours (192 clock hours). The detailed information as indicated below is based on one three hour laboratory per week for one academic year.

Teaching Methods—Glycosides

I have been asked to present teaching methods in the laboratory for implementing the objectives of the course in pharmacognosy using glycosides as a specific example of subject matter.

I *Laboratory Procedure.*

A. Crude Drug Extractives—Glycosides

The methods indicated in this section are used in the study of the physical properties and chemical activity of the pure glycosides with a view to compounding and drug evaluation. Problems of incompatibility and the determination of purity and quality of glycosides are considered.

1. Physical Properties
   a. Specific Rotation
   b. Melting Point
   c. Solubility – The solubility of glycosides is considered by actual extraction of glycosides from a crude drug using solvent extraction technique. The extraction of glycosides from crude drugs by chromatographic methods with student groups is suggested.
2. Chemical Activity
   a. Nature of Glycosides

      It is suggested that tests indicating the chemical nature of glycosides be used. Tests designed to show the presence of the sugar and the character of the aglycone portion of the molecule and the conditions required to bring about glycoside hydrolysis are recommended.

      Strophanthin Identification Text C.

      Microchemical Test for cyanophore glycosides

      Effect of moisture on glycosides in wild cherry bark and mustard seed.

   b. Identification Tests

      These kinds of tests are included in the official compendia as an aid in the identification of glycosides and crude drugs containing glycosides. They are of a micro and macrochemical nature. It will be noted that these tests alone are not sufficient to identify the purity and quality of a drug but are merely an aid.

      Borntrager Test – Anthraquinones

      Alkali Test – Anthraquinones

      Iron Test – Tannins

      Color Test – Ouabain

   c. Precipitant Reactions

      These tests have been included to indicate possible incompatibilities

      Iron Test – Tannins

      Alkaloid – Tannins

B. Crude Drug (Glycoside containing)

The assembling of a collection of crude drugs by each student is intended to emphasize those characteristics useful in identifying a crude drug, the kinds of plant parts that yield medicinal material and to provide a basis for considering the importance of plants to man.

1. Macroscopic Study

   Student collection of 140 crude drugs in cellophane bags. The size, shape, color, odor, taste and other distinguishing characteristics of the drug are considered.
2. Microscopic Analysis

   This portion of the laboratory procedure is concerned with study of cells, tissues and cellular inclusions for the purpose of determining identity and purity. The microprojector, polarizing microscope, ocular micrometer, microchemical apparatus and routine laboratory reagents are used. This method of analysis is indispensable in the study of drugs of natural origin.

II *Examinations – A Teaching Aid*

The student's accomplishment in the laboratory course is determined by a consideration of several factors.

1. Crude drug examinations
2. Examination of unknown drug samples – physical properties, chemical activity, cellular elements and inclusions. The analysis of powdered drug samples stimulates student interest and aids in application of previously acquired information.
3. Written examinations designed to emphasize application of laboratory work.

III *Visual Aids – A Teaching Method*

1. The following projectors are used – lantern slide, microprojector, opaque, 35 mm and 16 mm.
2. A collection of official and proprietary preparations containing crude drug and/or crude drug extractives is also used in the laboratory.

A proposed laboratory course in pharmacognosy including 32 laboratory periods and based on the methods outlined above has been reported in a previous paper (2).

SUMMARY

Methods applicable to a laboratory course in pharmacognosy using the biochemical approach with glycosides as an example is presented. The teaching methods include laboratory procedures used with crude drugs and their extractives, examinations and visual aids.

1. Blauch, L. and Webster, G. *"The Pharmaceutical Curriculum"* American Council on Education, Washington, D. C. 115 (1952)
2. Mercer, F. L. and Zupko, A. G., American Journal of Pharmacy Ed. 17, 81 (1953)

TEACHING METHODS IN PHARMACOGNOSY

III The Area of Alkaloid Drugs

H. W. YOUNGKEN, JR.
University of Washington

The importance of alkaloids and alkaloidal raw drug materials makes this area one of common use for exercises in pharmacognosy laboratory. Many simple yet informative teaching methods may be demonstrated when this subject matter is the topic for the class.

Different approaches are employed in the teaching of pharmacognosy for arranging the subject matter of alkaloids. For example, it may comprise a major division in the course outline during which representative plant drugs containing them are presented in a consecutive fashion with the emphasis given to the chemical relationships among alkaloids (e.g.—phenylethylamines, pyrroles, tropines, isoquinolines, indoles, phenanthrenes, etc.); or the subject matter might be scattered intermittently throughout the laboratory and lecture such as when a taxonomical, morphological, or physiological type of approach is followed. It is not the intent of this discussion to defend or recommend any one of these methods, but rather to demonstrate certain techniques which might be employed as teaching tools whenever the subject is encountered in the laboratory.

Since good teaching methods are related to good course arrangement, one should not entirely dismiss the latter at this point. Student learning in the laboratory can only be effective when exercises have some relationships both to the lecture and to each other at the time that they are presented.

It is with this in mind that we propose to demonstrate effective methods for teaching subject matter under the broad scope, alkaloids. We believe the methods work best as far as the student learning is concerned when their attention is drawn to the alkaloids as a group of plant biochemical principles with the emphasis at the cellular level. The major objectives as far as the student and the laboratory are concerned with this subject are the following:

1. To achieve a mental (perceptual) learning of the subject by *visual* observation of alkaloids as plant constituents.
2. To associate certain alkaloids with living drug plants and their parts from which they are separated.
3. To recognize certain problems often encountered during the separation and purification of alkaloids from plant materials.
4. To learn certain microchemical and semi-microchemical techniques employed for alkaloid identification of small sample sizes.
5. To become acquainted with suitable library references on the subject and with the general information these afford.

Those objectives are interrelated. The following teaching methods are a few that might be employed for meeting the objectives: The order in which they are presented here need not be rigidly followed; we believe it to be a useful order for a lecture-laboratory sequence.

1. Plants and plant tissues as sources for certain important *drug* alkaloids:

   Teaching Methods:

   a. Employ herbarium specimens, charts, kodachrome slide projections, and living plant materials. Arrange a drug plant garden field trip before commencing the laboratory exercises on the subject. Point out the botanical problems of plant authentication when possible. (slide 1)

   b. Emphasis might be placed at this point in the lecture upon the alkaloid raw drug or plant natural history, geographical distribution, and importance in drug commerce. Or this subject can be deferred until more appropriate elsewhere in the lecture. A representative number of pharmaceutical preparations (including specialties) should always be on display* in the laboratory so that interest can be drawn to this aspect of the subject. (slide 2)

   c. Assign student reference reading and reports on a selected few topics relative to the above. Stimulate "library browsing" by making some of these references available in the laboratory.

   d. Arrange laboratory recitation or discussion periods for the subject. Provide time for student verbal reports. Invite student — student questioning and examination.

   e. The notebook should include reports — less emphasis on artistic drawings.

2. Problems encountered during separation of alkaloids from plant tissues:

   Teaching Methods

   a. Select a few representative microscopic sections and powdered alkaloid raw drugs and by means of the micro-projector or other visual means, show the microscopic nature of plant tissues and their components from which the alkaloid separation must be made. (slide 3)

      1. Tissues of use in identification can be cited but not emphasized at this point.
      2. The overall nature of the crude drug "ballast", adulteration and contamination can be better visualized by its microscopic examination and *visual projection*.

   b. Show by means of a *diagrammatic chart* the general steps that might be employed during vegetable drug extraction. Project this chart on a screen for visual observation and discussion. (slide 4)

   c. Assign student groups to exercises dealing with laboratory extraction of one or more alkaloid drugs. Project slides showing the

*Displays that are arranged by associating finished preparations with other factors such as the raw drug, chemical structures of important components, and pharmacological relationships can be very useful teaching tools.

equipment desirable for this, pointing out the problems often encountered.

1. The continuous extraction technique. (Slides 5, 6)
2. The solvent-solvent separation technique. (Slide 7)
3. The chromatographic column separation method. (Slide 8)

d. Carefully provide for groups to perform certain operations* and invite class discussion of the good and bad results. Make sure that the reasons for each step are understood; for example, have student groups collect benzene and chloroform fractions for further quantitative alkaloid studies. Since the laboratory is not intended for quantitative alkaloid analysis, these may be performed by the staff and assistants. In some cases, crystallizations for quantitative examination may be completed by students in pharmacognosy.

*Note: The citric acid extraction method devised by Witt, J. A. et al (J. Amer. Pharm. Assoc. Sci. Ed. 42: 63-65 (1953) for Solanaceous alkaloids during which 1 gram or less samples are employed can be effectively used here for teaching purposes.

3. Micro-quantitative alkaloid identification: Several rather dramatic microchemical and semi-microchemical methods may be employed in the laboratory for demonstrating visually alkaloids or their salts. However, great care must be exercised in selecting only those tests which are simple and give good results. Such methods embody alkaloid color reactions, precipitations, and crystallizations. These exercises afford a means for demonstrating the presence of the alkaloid in a solution or powdered mixture. Further, they enable students to learn methods for examining very small quantities of alkaloidal materials with microchemical techniques. The use of polarized light often aids during these exercises.

Teaching Methods

Certain specific examples of teaching methods applicable to this phase of the study may be seen in a typical series of laboratory exercises included in the accompanying outline of laboratory directions employed in our laboratories. Laboratory records for student completion are also indicated in the outlines. The following are representative examples:

1. Demonstrate by means of visual projection an exercise during which color reactions may be employed to denote the presence of (a) Solanaceous alkaloids (the Vitali-Morin reaction) and (b) the ergot alkaloids (the Van Urk reaction). Assign students to groups and perform these tests with each group. (Slides 9, 10)
2. Students should then perform microcrystallizations of certain alkaloids during which the properties of alkaloid crystalline structures may be observed under certain specific conditions:

a. *Hydrastis alkaloids* — Illustrate a direct crystallization of an alkaloid from this raw drug with a strong acid. By means of the projector, point out where in a cross or longitudinal section students might expect to find alkaloids formed. (Slides 11, 12)

b. *Caffeine alkaloids* — Illustrate microsublimation of this alkaloid from a powdered drug and direct microcrystallization of its salt or base. Compare the nature of the resultant crystallizations under polarized light. Note differences in physical forms as a result of these procedures. (Slides 13, 14, 15)

c. *Morphine, codeine, scopolamine, cocaine, atropine, hyoscyamine, and strychnine alkaloids* — Microscopic examination of the precipitates of these alkaloids with a number of alkaloidal precipitating reagents serves to demonstrate the microscopic nature of incompatibilities and at the same time differences in physical forms which result. Crystals of morphine and codeine from Marme's reagent (potassium-cadmiun iodide) scopolamine and cocaine gold chlorides, and the picrates of atropine, hyoscyamine, and strychnine illustrate this point with respect to these alkaloids. Illustrate by means of slides or demonstrations the results which should be expected. (Slides 16-24)

Note: During the demonstration of these techniques, care should be exercised to review and correlate the findings with other material previously covered in the laboratory, e.g. the distribution of alkaloids in drug plant tissues, their physical properties as bases and salts. the nature of their existence in the cell, etc.

The important teaching method here is to select a group of drug alkaloids which can be crystallized microchemically with ease and which show marked differences. Demonstrate beforehand the results of the laboratory crystallization so that each student can observe what is to be obtained. Then following this laboratory exercise, proceed with other precipitations and/or microcrystallizations of a more difficult nature, e.g. double salt crystallizations, etc. until students can gain confidence with the methods.

SUMMARY

The above methods when carefully planned serve the objectives of the laboratory well. There can be a better association of the various problems encountered in alkaloid extraction and their physical and chemical properties with the raw drug and cellular tissues from which they are obtained. Dynamic application of microchemistry make the alkaloid real whether its form be seen directly (crystals) or indirectly by color or other tests.

TEACHING METHODS IN PHARMACOGNOSY

IV The Antibiotic Drugs

H. E. Bailey
Wayne University

The rapid expansion in the field of antibiotics during the last decade has created an area of considerable interest for the pharmacognosist. Since it is a new field and is considered by some to belong mostly to the field of microbiology, the tendency has been to devote but little time to it in the pharmacognosy laboratory. The fact that the antibiotic drugs are produced by micro-organisms under very different conditions from drugs produced by higher plants need not set them as a group apart. If we should allot time to each subject in the pharmacognosy laboratory commensurate with its importance in the practice of pharmacy, the subject of antibiotics should be placed high on the list. No laboratory manuals are available for use as guides in selecting experiments on antibiotics, but many ideas for demonstrating the important points made in the lecture may be gained from the U.S.P. and from books on antibiotics. Among the subjects that lend themselves to classroom demonstrations are the following: stability, solubility, identification tests, the detection of antibacterial substances, and the culture characteristics of the organisms.

Teaching methods and classroom procedures used in considering antibiotic drugs may be similar to those used for the other drugs. Student participation in actually carrying out the experiments is the most effective method of teaching wherever there are materials and facilities available. Many antibiotics lend themselves very well to laboratory experiments and may be used in various ways to demonstrate their properties. Written reports on the experiments performed in class and discussions on assigned subjects are also part of the laboratory program. Different types of antibiotics are placed on display to aid the student in becoming familiar with these products. During the laboratory period the student should gain some concept of what an antibiotic is, where it comes from, and some of its distinguishing characteristics.

I. Micro-organisms which produce antibiotics
   - A. Review morphology. Since the morphology of many antibiotic producing organisms is similar within a particular genus, little is gained by making detailed studies on each species. Stock cultures and culture slides of these organisms may be used for observation and comparison. It should be noted that the soil is the main source of antibiotic producing organisms.
   - B. Detection of antibiotic activity. Many organisms will produce antibiotics readily in culture. The agar substrate or the culture solution may be tested for the presence of antibiotic activity by using any one of the following methods:
     1. Streak-plate Method. On previously prepared agar plates, streak bacteria at right angles to the antibiotic producing organism or to a strip of filter paper that has been moistened with an antibiotic and placed near the top of the plate. Record the differences in inhibition to show the effect of the antibiotic on the bacteria. (Slide 4)
     2. Paper-disk Method. Apply sensitivity disks that have been impregnated with a given antibiotic to seeded agar plates and note the differences in inhibition. Point out that the disks may be use clinically in determining the antibiotic of choice where the organism causing a disease in a patient has been isolated. Sulfa disks and other substances which produce inhibition may be compared with an antibiotic. (Slide 5)

II. Laboratory Experiments on Antibiotics
   - A. Stability. Of the various desirable characteristics which an antibiotic should possess, stability is one of the most important. Since the pH of a solution is closely associated with the stability, the pH must be considered along with temperature, and other inactivating substances. To emphasize the need of having a stable form of an antibiotic, one can cite the difficulty that was had in the production, purification and early use of penicillin before it was obtained in a crystalline form.
     1. To note the loss in activity of an antibiotic upon heating, penicillin may be used. The activity is rapidly destroyed upon boiling. Contrast this to streptomycin which is relatively stable.
     2. To show the inactivation of an antibiotic by an enzyme penicillinase can be used. This enzyme inactivates penicillin in solution and the loss of activity may be noted by the usual tests. It should be pointed out that the enzyme is used in the U.S.P. sterility tests.
   - B. Solubility. To demonstrate the solubility in different solvents, penicillin may be selected again. The salts of penicillin are soluble in water, but relatively insoluble in organic solvents; the reverse is true of the acid form. This difference in solubility provides a means for the extraction and purification. A laboratory experiment showing the principles involved may be used.
   - C. Potency. Where an antibiotic cannot be obtained in pure form, a unit may be devised as a measure of potency. Although penicillin is now obtained in crystalline form, the unit is still used. One of the things that impresses the student is the very minute amount of antibiotic that constitutes a unit. A vial of penicillin containing 100,000 units marked with the weight is passed around and the students are asked to calculate the number of units per milligram. Comparisons are also made with other antibiotics.
   - D. Identification tests. In common with many other drugs, there are microchemical tests and color reactions which aid in the identification and assay of certain antibiotics. In some cases the methods may be used in the assay as well as in the identification, since the intensity of the color produced is a function of the con-

centraction. (Slide 7)

E. Chromatographic Methods. Paper partition chromatography may be used as an aid in the identification of certain antibiotics. These have the advantage that after chromatographing they may be identified by means of zones of inhibition as well as by the use of reagents. (Slide 8)

F. Polarizing Methods. Crystals of certain antibiotics such as penicillin G, procaine penicillin, and chloramphenicol may be polarized under the microscope as an aid in the identification.

General Discussion at close of all papers.

A question as to the objectives of the laboratory arose. It seemed to the observer, from the papers given, that everyone was still treating substances singly, that is, a drug was taught as a drug. The question was raised as to how effective this method was; how often would one use the same tool?

A reply to this was that one should use the same tool as often as needed. A second reply was that a particular technic should not be used too often.

Comment to the effect that why not teach methods rather than groups of drugs.

Reply that drug principles should be covered, not methods and that principles should not be sacrificed in order to teach methods.

The group finally agreed that methods should be taught but not at the expense of teaching drug constituents.

SOME OBSERVATIONS ON TESTING IN THE FIELD OF PHARMACOGNOSY

EDWARD P. CLAUS
University of Pittsburgh

The subject of discussion for this afternoon's session in the field of Pharmacognosy is "Testing" which has been ably considered this morning by Dr. Ebel. I know that we have all learned a great deal from Dr. Ebel's presentations; our purpose this afternoon is to apply his ideas to the subject matter in our field. It has been suggested by the committee in charge of this Seminar that some of our time could be well spent in constructing typical examination questions in pharmacognosy. Your discussion leaders this afternoon thought that this suggestion was excellent and we have attempted to focus our plans in that direction. If you are not already acquainted with my colleagues on this platform, let me introduce them: Martin S. Dunn, Professor of Biology and Director of the Biological Laboratories at the Philadelphia College of Pharmacy and Science, and Melvin R. Gibson, Associate Professor of Pharmacognosy at the School of Pharmacy of the State College of Washington, and just for the record, your present speaker is Professor of Pharmacognosy at the School of Pharmacy of the University of Pittsburgh.

Our time for this session has been curtailed to an hour and three quarters to permit us to join with the Plant Science Seminar in their tour of the University Gardens and Greenhouses and to hear the paper by Dr. Mehlquist on "Somatic Mutations and Flower Color Genetics." Accordingly, we have constructed a program that restricts presentations and discussions to a rigid time schedule.

We have allotted 15 minutes to each of the three of us. At 2:15 there will be a ten minute period to discuss all three presentations. At 2:25 we will take a ten minute "break" following which, at 2:35, we expect to begin discussion of the subject "Test Construction." It will be necessary for us to conclude at 3:15. Since I have already used two of my precious 15 minutes, let me now state my thoughts on three different subjects:

1. The "normal" grade curve, its importance and consequences.
2. An interpretation of "vague" student answers.
3. Some advice and constructive criticism which may be offered to graduate assistants and young instructors.

1. The Normal Grade Curve, Its Importance and Consequences.

How strictly should the teacher adhere to what is known as "the normal grade curve?" Ebel has indicated in his outline this morning that in every class there are "ensigns" as well as "admirals," that there are good and poor ensigns just as there are good and poor admirals, and that even in an advanced graduate class where you might expect to find admirals only, there will still be good and poor admirals. While one cannot refute the soundness of this position, does it necessarily mean that there will be the same percentage of failures in a graduate class in pharmacognosy as in a freshman class in biology? If the teacher consistently applies the so called "bell-shaped" curve to each class that he teaches, he will always have failures in those classes. Will this lead him to remark to his class in his introductory lecture, "Ten per cent of you will fail this course," as, I am told, some student classes have been informed?

The normal grade curve has been established after compiling the information obtained from literally hundreds of teachers utilizing the grades of many thousands of students. If we study the nation-wide figures over a period of years we can arrive at the normal curve. How, then, can this be applied to any one class which numbers perhaps 60 students? If the examination results for a class in beginning pharmacognosy are employed to establish the standings of the students in the class so that the students may be rated from number 1 down to number 60, it has fulfilled its purpose. If three major and five minor examinations are conducted during the semester, the standings from number 1 to number 60 derived from these averages represent a well-balanced system of evaluating students' knowledge of the subject matter. However, I do not believe that numbers 55 to 60 should be failed automatically. Dr. Ebel has substantiated this attitude, also.

We teachers have all had the pleasure at times in our teaching careers to meet with a class that is more responsive, more interested, and more cooperative than those of the past years. Whether this is due to our own efforts is doubtful since we conducted our teaching that year in much the same manner as in preceding years. If the class includes 60 students naturally the class standing must run from number 1 top-man to number 60 low-man; but, in this case, number 60 low-

man is far better than the number 60 low-man of the several previous years. It may have been that in the class of the next year, a general lack of response was apparent and both number 1 top-man and number 60 low-man were below those of the year before. Should there be ten per cent failures (or even eight per cent) in both classes? Or might it be that the ten per cent average balances one year against the next? Could there be but 2 failures in the "good" class and 10 failures in the "poor" class to give a total of 12 for 120 students in two years, an average of 6 per year thus retaining the ten per cent failure average if that figure has been selected as a desired percentage by the teacher?

Again, if there be good and poor admirals, there certainly must be good and poor teachers, and similarly, good and poor classes. Does the combination of a good teacher and a good class add up to the same percentage of failing grades as the combination of a poor teacher and a poor class? Can a teacher measure the efficiency of his instruction in any way other than by the marks attained by his students? If, through the medium of such a Seminar as this in which we are participating, we are to become better teachers, what should we hope to gain? Making the subject matter more interesting? We are not here to give attention to course content – that has been the purpose of the five preceding Teachers' Seminars. Ways and means of presenting our subject in a more satisfactory manner? That is our chief objective. Blauch has told us that we should establish our objectives, prepare our courses, and make daily preparation for each class; he has given us directions for conducting classes, for counseling students, for evaluating students' attainments, and for disciplining students. The other members of our faculty have elaborated upon this theme. If, after having gained a better insight into my profession of teaching, I feel that I must return to Pittsburgh and next year automatically record the "normal" ten per cent failures, I should feel that this week has been wasted. Please do not misunderstand, I have no compunctions about weeding out those students who are incapable or unwilling to maintain a passing grade. If I have given you that impression, I hasten to correct it! My point is this: if everyone in a certain class has, in my opinion, performed above and beyond the call of duty in maintaining the minimum average, everyone deserves to pass.

2. Interpretation of Vague Student Answers.

To develop this point we must consider the possible reasons for such vagueness. Either the student is totally ignorant of the answer and is attempting to disguise his lack of knowledge, or he does not know the exact answer and endeavors to record what he does know about the subject, or he misinterprets the meaning of the examiner and presents an answer which he considers correct and adequate. A number of years ago I had the unusual experience of grading an examination paper in which the student had written his name instead of the expected answer in as many as twenty places on the answer sheet. When queried about this strange procedure, the student replied that he had been advised never to leave a vacant place on an answer page, presumably with the idea that the examiner did not read the answers. This, of course, is an extreme case. Other students in covering their lack of knowledge sometimes will give a totally foreign answer. Obviously, such instances occur chiefly on the essay type or "fill-in" type of examination. Again, on the essay type, the student who does not know the exact answer may wish to indicate that which he does know. With the objective type, he does not have this opportunity.

The most disconcerting predicament which a student must face during an examination is his inability to fathom the meaning of the examiner's question. Not only is he concerned with the fleeting minutes, the usual interruptions through announcements of one kind or another, and his own state of nervousness, but still worse, he must take time to wonder what was in the examiner's mind when he encounters an ambiguous or a nebulous question. Of course this incident will occur more frequently on the essay type examination than in the objective type but it may happen in both. Let us consider several examples of each of the aforementioned instances:

a. Question: State the official definition for Opium.
   Student answer: Dried juice of the poppy capsule.

Here, there is no doubt that the student does not know the complete definition for Opium and is merely bluffing.

b. Question: What does the U.S.P. state regarding the yield of Belladonna Leaf?
   Student answer: The U.S.P. states that Belladonna Leaf should yield not more than 3 per cent of acid-insoluble ash.

In this case, the student is entirely within his rights in expecting full credit because he has actually quoted a statement from the U.S.P. If the examiner counters this claim by stating he meant the alkaloidal yield and marks the answer wrong, he is unjustly taking advantage of his position.

c. Question: One of the following alkaloids has nothing in common with the others in the series. Cross out the unrelated name.
   Papaverine
   Strychnine
   Morphine
   Codeine
   Narcotine
   Student crosses out narcotine.

Obviously, the examiner had the word "strychnine" in mind when he composed the question. It may be that the student was thinking about alkaloidal salts, realized that all of the alkaloids named except narcotine were official as the salts, and so eliminated narcotine. In such cases, particularly where student thought is involved, the examiner would aid himself as well as the student by requesting the reason for the student's answer. If the question had been so stated, it would probably have prevented a disagreement between student and teacher. If such cases are discussed by the examiner during class hours, the sympathy of the class is with their fellow student and the examiner is accused of unfairness.

d. Question: State the meaning of (a series of terms including) antitoxin.
   Student answer: Antitoxin means against poisonous waste products.

The student has taken the question literally; thus,

anti means against, and toxin refers to bacterial and other toxic metabolic products. The examiner wanted the definition of the term antitoxin as a biological product, particularly, a solution of antibodies derived from the blood serum of an animal immunized against a specific toxin. We might argue all day on matters such as whether or not the student is bluffing. But how much simpler it would have been for the examiner to word his questions in a specific manner!

All of the preceding brings me to my third point:

3. Advice and Constructive Criticism for Graduate Assistants and Young Instructors.

In many schools it is customary, although unfortunately so, for laboratory assistants, readers, and newly appointed instructors to do the actual grading of the examination given by the professor in charge of the course. This practice is prevalent in certain areas of instruction in our colleges and, no doubt, occurs in the pharmacognosy department also. On occasion, in my own courses, it has been necessary for me to resort to such an arrangement when press of other duties was too great. With some professors it is the rule rather than the exception.

In many instances, the professor composes a master key which he gives to the assistant to use as a guide. However, a key for such use is best adapted to the objective type of examination in which the answer is either right or wrong. For an essay type examination a key has little value – the assistant must know what is and is not expected from the student. As we all know, individual interpretation will vary from professor to assistant. While it is true that experience is the best teacher, the assistant should not gain such experience at the expense of the student's grades.

In all cases where the assistant grades the examination papers, the professor should critically evaluate the results and the class average. Often a graduate assistant or inexperienced instructor becomes too meticulous in grading questions. For instance, consider this question: Give the chief constituent of Nutgall. A student who answers "tannic acid" may be given no credit if the assistant wants the word "gallotannic acid" instead. When the student complains, he may be told to be more specific.

This is a situation where the professor may find himself on the spot if the student approaches him for advice. The professor should stand back of his associates in his department for obvious reasons; yet, if the student asks, "Isn't gallotannic acid merely a synonym for tannic acid? If you wanted synonyms, why didn't the question specify it?" Thus, the professor is placed on the defensive and the student is accusing the assistant (or the professor) of the same lack of specificity for which he himself is being penalized. If the majority of the class lose credit for the answer "tannic acid" instead of the expected "gallotannic acid", they begin to feel persecuted and harbor animosity against the department as well as the subject. On the other hand, a pre-examination conference between the professor and his graders should focus attention on such matters and create a departmental policy that should lead to better understanding among all concerned.

It is not unusual for an instructor to inform his class beforehand of the type of answers he expects on his examination. He may wish certain questions answered very briefly or he may require certain interpretations. If, however, the professor has notified the class of such modifications and then, for some reason or other, neglects to tell his readers about his notice, heaven help the unfortunate reader who considers such answers incomplete and grades accordingly. If this situation should pass unnoticed by the professor and the papers are returned by the reader, the class will justifiably feel that the "double cross" has been applied.

In charting our objectives and in planning our courses, frequent conferences between the professor and his staff are necessary to acquaint the junior members of the department with what is expected of them, with changes in arrangement of lecture or laboratory classes and with the addition of new subject matter. Similarly, the construction of an examination, the evaluation of the questions, and the subsequent grading of the papers should be discussed. Questions of policy and departmental cooperation are of utmost importance to the neophytes to whom we entrust our classes. We, as teachers, are actually perceptors to those under us, and we should accept that responsibility whole-heartedly.

All of the foregoing indicates that I am as much concerned with students and students' reactions as with teaching and with methods of presenting subject matter in pharmacognosy. The teaching profession to me is a three-way proposition, a triangle with one corner occupied by the teacher, another by the subject matter, and the third by the student. It is our duty as teachers to stimulate the student to acquire a satisfactory amount of the material comprising pharmacognosy. How we do it is our prerogative. But we must not lose sight of the fact that without students there would be no teachers. Pharmacognosy, to me, is a living subject that is of vital importance to the embryo pharmacist in his understanding of the art and science of pharmacy. Without it, the student cannot comprehend certain phases of his chosen profession. Too many students in the past have had what small flicker of love they had for the subject extinguished by superfluous details, haphazard examinations, careless grading, and lackadaisical personnel. If we, through the medium of this Seminar, can overcome even a small part of this irresponsible attitude, we can feel that it has been a profitable and invigorating experience.

ESSAY AND SHORT-ANSWER QUESTION IN PHARMACOGNOSY

MELVIN R. GIBSON
State College of Washington

Frequently among my colleagues I bring up the necessity of students in pharmacy doing less rote memory and more constructive thinking. I do not think any of them disagrees with me, and occasionally I even get indulgent smiles, but I wonder what they are doing about it. And I wonder what we are all doing about it!

I think one of the most caustic criticisms I have heard leveled at pharmaceutical education was relayed to me this last year. It emanated from an engineering professor on our campus who was chastising

his class for not knowing the significance of principles. He said, "Here we learn practical, basic principles for application. If you want just to memorize, go over to pharmacy." I was shocked both by the abruptness and the poor taste of his statement. And I think this, more than anything else, prompted me to write a paper which will appear in the next issue of the *American Journal of Pharmaceutical Education*. I hope you read it; because we in pharmacognosy have a real challenge in teaching to keep our courses from being masses of improperly organized minutiae which provide rote learning.

Our first obligation is to teach courses which present material not as mere points seriatim, but, rather, courses which encompass facts which are organized to elicit generalizations and foster an appreciation of their functional values. Once we have learned to teach a course with these objectives in mind, our second obligation is to motivate the students to appreciate this co-ordination and utility in their study. And one of the most salient motivating catalysts of student study habits is testing.

Too often, I think, we consider tests as simply methods of sampling information at the disposal of the students rather than as very potent means of influencing learning processes. If we teach, for example, by simply naming the drug, its synonyms, source, part used, use, and dose and then hurry on to the next drug, we have left a fertile field for rote memorizing *and* prompt forgetting. I think we should remember that, "It is the pattern and not the individual contents that constitutes the memorial residuum." (1) In pharmacognosy the pattern must be a cognizance of the grouping of the drug, the general properties of that group, the idiosyncrasies, anomalies, the importance, the function of the group, and the position of a drug in that group. The drug itself should become subsidiary to the general considerations of the larger category. And when we construct tests in pharmacognosy they must be tests that emphasize understanding of why, how, interpretation, explanation, significance; and we should make cautious use of questions that ask what, where, to define, to name, and to describe.

Some of you, I'm sure, will, in the tenor of self-justification, refute this statement by saying that our responsibility as pharmacognosists is to teach the name, the description, the definition, the what, and the where. In this I quite agree, but our larger responsibility is to prevent the development of a mass of tongue-tied, stammering pharmacists who are unable to evaluate and co-ordinate facts and thoughts into logical expression.

By now you will have guessed that this is an impassioned plea for the greater use of essay examinations in pharmacognosy and in all pharmaceutical education. "The ability to interpret . . . knowledge, to apply it effectively and arrange apt expressions so that it might be transmitted to others has received little consideration from the authors of objective tests." (2)

The construction of good essay questions is not an easy task, but with thought they can require the encompassing of much factual material desirable, yet requiring the student to sift the factual material and apply it to the problem under consideration — the ultimate goal of pharmaceutical education. In the essay examination the student is required to delineate his information on a point, whereas the short-answer test can sometimes elicit the correct response from marginal and hazy learning. When we consider what is a valid test, we must include in that determination of validity, "Does it encourage the student to *think* accurately?" In pharmacy a man must be able to think and act with precision. To quote a prominent text on achievement testing: "The best thinker is the one who not only has acquired the greatest amount of exact information, but who best understands the meaning and significance of, and the relationships between, the facts at his command, and who can best use these facts and relationships." (3)

I am quite aware of the necessity of sampling the largest amount of factual information learned in pharmacognosy. And there is no disputing the fact that short-answer questions can cover a mass of information in the shortest possible time. But let us also be aware that students . . . "memorize facts even though they may neither know why the facts are significant enough to deserve learning, nor appreciate the functional values of the information required." (4)

The solution, of course, is the use of both types of test questions in pharmacognosy, with an emphasis on the essay type. And may I point out that under no circumstances should the student know what type of examination is to be given. Essay exams, if announced, often discourage exact study, and students take a chance on knowing simple generalities of a few most important topics, whereas, announced objective exams bring about a study of isolated, multitudinous facts with little thought to their organization, significance, and meaning. Students should always be encouraged to learn facts as parts of a large whole of knowledge and appreciate the significance of the interrelationships.

The time for testing factual information is, in my estimation, in 15-20 minute quizzes given every two weeks. But to alleviate the directed study, at least one of these should be of the essay type. I think a minimum of three one-hour examinations should be given per semester which are partially made up of essay questions and partially objective-type questions, with the primary emphasis on the essay type. I think semester final examinations should be largely of the essay type to stress broad, general information patterns. I don't think essay-type final examinations given year after year are of any consequence in directing study because the concentrated study during the semester has not been of the directed type. I think the primary importance of final examinations, anyway, is not so much to sample the students' knowledge, but to encourage them to view the course as a large unit, made up of major and minor subdivisions bound together with reason and functionalism.

In making this suggestion for the use of greater numbers of essay questions, I am fully aware that an essay examination does not effectively test the student whose powers of expression are poor. Often this type of student has difficulty in organizing factual material and expressing it coherently. To quote Joseph R. Starr: "Students are asked to compose under pressure

and with a prize – a good mark – to strive for. I know of nothing better designed to promote the facility in the use of one's mother tongue." (5) Again, an examination is not only a sampling device, but also a tool of instruction. It is instruction in retention and expression. In retention, to quote Brand Branschard in his volumes on *The Nature of Thought,* "Now words do for the free idea what sensations do for the tied idea; they give an anchorage in the sensible which prevents its immediately drifting off." (6) Instruction in expression, from Alexander Pope, "True ease in writing comes from art, not chance, as those move easiest who have learn'd to dance."

Our responsibility in pharmacognosy is not only to the acquisition of factual material, but a responsibility to attach significance to the facts in the students' minds, to prepare them to retain it, and to give them the practice in reasoning, and practice in applying it to functional use. And this I feel can only come about through the greater use of essay-type testing.

REFERENCES

(1) Ogden, R. M., *Psychology and Education,* Harcourt, Brace, and Co., New York, 1926, p. 178.

(2) Eurich, Alvin C., and Appel, Francis S., "Essay and Objective Examinations in English Literature," *Studies in College Examinations,* University of Minnesota, The Committee on Educational Research, Minneapolis, 1933-34, p. 92.

(3) Hawkes, Herbert E., Lindquist, E. F., and Mann, C. R., *The Construction and Use of Achievement Examinations,* Houghton Mifflin Company, New York, 1936, p. 86.

(4) *Ibid.,* p. 90.

(5) Starr, Joseph R., "Points of View of Instructors, III," *Studies in College Examinations,* University of Minnesota, The Committee on Educational Research, Minneapolis, 1933-34, p. 23.

(6) Blanschard, Brand, *The Nature of Thought, Vol.* 1, George Allen & Unwin, Ltd., London, 1948, p. 538.

(7) Pope, Alexander, "Essay on Criticism, Part II," *The Complete Poetical Works of Alexander Pope,* Houghton Mifflin Company, New York, 1903, p. 72.

Pharmacy Administration Section

THE TEACHER

Discussion Leader: J. H. Goodness
Massachusetts College of Pharmacy

As teachers, the faculties of colleges of pharmacy like the faculties of universities occupy a unique position in the educational world. While elementary and high school teachers are almost universally required to be formally trained in methods of instruction before qualifying as applicants for teaching positions, teachers in colleges and universities generally seek, obtain and hold their positions without such preliminary or subsequent formal training. The applicant's preparation in and his knowledge of course content and not his mastery of techniques of teaching are the primary and sometimes the sole concern of college administrators in selecting faculties. Thus by intent or compulsion of circumstances this practice establishes a reliance upon the applicant's collegiate degrees and his knowledge of subject matter of the course he is to teach as an index of the applicant's ability to teach. The possibility of error in selecting effective teachers under such a system is patent.

Since most applicants have not had training in methods of instruction, the usual consequence is that each new member of a college faculty finds himself faced with a chain of choices: first whether to disregard or to seek information on teaching methods, and second, if the decision is to seek teaching skills, whether to acquire these skills by the trial and error method, the observation and private study method, or the enrollment in formal courses on teaching techniques. Each choice may well lead to a different type of teacher.

That our college faculties accomplish as much and succeed as well as they do even when no preparation is had in teaching methods is not due to the fact that methods are not important in teaching, but rather to the quality of our students. College students generally possess a maturity and sense of values which greatly assist the teacher in reaching his goal. And the fact that students entering a college of pharmacy have selected their life goal and thus directed their interests makes the problem of teaching even smaller. Under such circumstances the college teacher may find that he solves many of his teaching problems by the simple expedient of an orderly organization of course content, and therefore may reach and preach the conclusion that in college – teaching scholarship is everything and methods of teaching nothing. This view is held by many teachers of graduate schools and perhaps with some justification, but an objective analysis of undergraduate school teaching reveals that there is still much room for improvement, particularly in the teaching done by beginning teachers, those of instructor rank, and those working with the "fundamental" courses. This is not to say that the older teacher or those in "advanced" courses could not profit by a review of methods.

It is these observations that make me, and perhaps without exception, every one of us in attendance here, so grateful to the Foundation, the A.A.C.P., the committeemen and the speakers for their efforts in arranging this exceedingly important seminar for the benefit of the "double profession" of teaching in pharmacy.

For this session of the Pharmacy Administration group the program has assigned for consideration those problems and methods which confront a teacher *before* and possibly after the actual presentation of course content. The problems and methods of the presentation of course content are assigned to subsequent meetings and we should therefore restrict our discussion, especially in the first session, to the assigned topics. By doing so, each session will have its own area of discussion and will yield as full and complete coverage as is possible in the time allotted.

During this session we are to concern ourselves with the pre-presentation problems and methods of the teacher in the following subjects under whatever titles or groupings they may be found in our colleges:

Economics
Accounting
Display
Salesmanship
Advertising
Marketing
Business Law
Drugstore and pharmacy management
Pharmaceutical jurisprudence
Statistics
and related subjects

So that we may obtain the greatest personal benefits, I suggest that our discussion proceed without fixed plan and that each of us either by questions or by answers participate in such topics as interest us or may aid others.

The following list of clues to discussion topics is offered without intending in any way to direct or to limit the discussion and merely as a reserve from which we may draw if so inclined.

I. Questions on material introduced by speakers during the morning program

II. Do subjects of the "science" type require teaching methods different from those useful for the "art" type subjects?

III. Problems concerning the elements found in a teaching situation:
- A. The ideal teacher
  - 1. Training and future training (Law, business, statistics, etc.)
  - 2. Personality traits affecting teaching.
  - 3. Attitude toward subject matter, students, the institution, society
  - 4. Personal goals
  - 5. Academic freedom
- B. The students
  - 1. Variance in goals and their effect on subject matter and methods
  - 2. Variance in intellectual quality and capacity
  - 3. Variance of interest in subject matter
    - a. Attitude toward law, psychology, business, and "social science" courses
  - 4. Other variances affecting teaching or methods.
- C. Course content
  - 1. Specific goals for each course of the department
  - 2. Sequence of courses (when choice is available)
  - 3. Selection (and rejection) of topics in each course
  - 4. Topic order or sequence in a course
  - 5. Textbooks and other sources of information
  - 6. Slanting of courses (By ethics, retailer or other interest, as preparation for subsequent courses, etc.)
  - 7. Opposing theories and divergent opinions
  - 8 Mimeographed material
- D. Methods of teaching. (Reserved for other sessions)
- E. Time
  - 1. Class time and nonteaching activities (Attendance taking, announcements, distribution of unrelated material, etc.)
  - 2. Class time apportionment to topics covered
    - a. See *"The Pharmaceutical Curriculum"*, Webster and Blauch.

  Which topics should receive greater time and emphasis?
  - 3. Class time allotment for testing
  - 4. Assignment load for non-class time

IV. Daily lesson plans
- A. Purpose of lesson plans
  - 1. Clarity, completeness, continuity, unity, of course content
- B. Preparation of lesson plans
  - 1. Physical form of plan and lecture notes
- C. Deviation from plan
- D. Questions from the floor during lecture

V. Class and classroom organization, management, and control

VI. Student counseling

VII. Record keeping (Academic bookkeeping)
- A. Subject matter files
- B. Attendance records
- C. Grades records
- D. Other records (Advisor systems, examination and quiz files, etc.)

VIII. Survey and compilations with student cooperation

IX. Miscellaneous (Publications and papers, Interdepartmental cooperation, etc.)

PHARMACY ADMINISTRATION

August 16th

"The Teacher"

Discussion Leader — J. H. Goodness

Recap of outstanding principles presented in morning session. Group was polled on what they thought was outstanding theme of morning session. Group feeling was MOTIVATION.

Teaching job was one of taking human being and training him in the system under which we live.

Point brought out that most students fall into a bell-shaped distribution curve. We must be prepared for some failures.

Point that we have scholars and students—Students a very heterogenous group, hence the question — to whom will we lecture? Great variation in opinions on this. Some want to aim at scholar and hence force lower student up. Others aim at middle, others start low and bring up standards gradually. This practice varies with the teacher and with the topic.

Pre-Presentation

We are always faced with the time problem. Can we accomplish everything with the tools available? Agreed that lesson plans and good planning tend to give us the maximum return for time spent. Lecture is still the quickest way to impart ideas.

Physical Aspects

Paramount that teacher get attention of the class before classes can begin. Different methods available but must get psychological control or leadership of group before teaching situation can proceed with best results. There seems to be no fixed patterns but are determined by individuals.

Discussed auxiliary features such as roll calls and seating arrangements. Again no fixed pattern but greatly varying opinions of how should be handled.

Course Content

Teacher should stick to outline.

Question of student interruption for questions during class period. Handled in different ways by teachers. Some allot time at terminal portion of period, others reserve for office hours.

Maxims of good teaching

Good teacher must be adept at:
- a. communication
- b. Salesmanship

Must get the students properly motivated at all times. The teacher must make the student do everything necessary so that goals and objectives may be accomplished.

Sources of Information

Dearth of texts and published material in field of administration. Suggested that Lilly Digest be incorporated into management courses. No agreement but all felt that it can be a guide as nothing comparable is available today.

Proposal of research to offset scarcity of material. Very debatable as to who will do it, when it will be done, where and on what. General feeling that gradu-

ate study and research is necessary to advance pharmacy administration to a position comparable to other fields of pharmacy.

Course emphasis in coming year

Group polled on what they were concentrating on in coming year. Following are the areas to be emphasized more this coming year than previous years:

a. Costs
b. Inventory Control
c. Salesmanship and sales promotion
d. Record keeping

INTRODUCTORY REMARKS

August 17th

CHARLES G. RABE
A. Ph. A. Headquarters

Classroom instruction in many of the courses in pharmacy administration may present problems less common in other areas of instruction in colleges of pharmacy. Courses in the sciences usually contain subject matter of a somewhat fixed and indisputable nature. Students are not prone to contradict the action of drugs, the structural formulas and reactions of chemicals, and the theorems of mathematics, but they do have frequent occasion to question the correctness and wisdom of the somewhat flexible rules of business management. And further, many of the students have had considerable practical experience in retail pharmacy and their interest in the courses in administration is such that they wish to share their experiences with others in the class. One cannot deny the potential value of their comments. It is because of these and other reasons that the teaching of pharmacy administration may require a somewhat different approach in the classroom.

The leader of this discussion does not wish to exert undue influence upon the nature of the proceedings; his major function is that of directing the discussions. However, it is always well to suggest an opening issue as a prompter in stimulating the participants into action; therefore, he does take the liberty to introduce the following statements as a means of getting the discussions underway.

One of the more important issues that should be discussed is, "Are courses in pharmacy administration taught more effectively by the use of the lecture method, student participation plans, or by a combination of the two?" A second question might read, "Which courses lend themselves to these various plans?" In this connection it is hoped that those in attendance will have at one time or another read the most excellent book, *Teaching in Colleges and Universities,* written by Blauch and Associates. Included in this book are chapters dealing with the Lecture Method, Discussion Methods, and Individualized Methods.

It is obvious that we cannot lay down specific rules for methods of classroom instruction in pharmacy administration, that is, rules that would apply to all colleges of pharmacy or to all of the various courses in this area of teaching. There are far too many types of situations to permit us to do so. For instance, some colleges may have no more than ten or fifteen students in a class, whereas others may have a hundred or more. It is apparent that the methods and techniques of instruction will have to be varied to meet these different conditions. Nevertheless, let us review as briefly as possible some of the various classroom methods, pointing out a few of their advantages, and weaknesses.

Some educators and students object to the use of the lecture method because it too often takes on the characteristics of a sermon. It is not unusual to find cases in which the lecturer will not permit students to ask questions or make comments during these class periods. And this situation is made worse by the fact that all class meetings are conducted by the lecture method; there are not student participation sessions. Many of the questions and valuable comments that the student had in mind during the lecture are lost.

The straight lecture method is regarded by some persons as being capable of creating a writer's cramp and a cerebral vacuum. Either the student is kept so busy writing notes that he fails to fully understand what is being said, or else he becomes so enthralled by the eloquence of the lecturer that he fails to take adequate notes. It is not unusual that some educators do develop into the preaching type of teacher; the desire to talk is an almost universal characteristic of mankind and flourishes in an academic climate.

Critics of the lecture method point out that entirely too much time is devoted to presenting the obvious or that which could and should be learned by the students from textbooks and reference books. The practice of "spoon-feeding" the students helps to destroy their abilities to read and to correctly interpret that which they read. It is often said that some of our teachers are not fully aware of the fact that the printing press is now in popular use, and that students have ready access to many books.

Those who defend the lecture system state that it has many advantages despite the aforesaid deficiencies. They say that it enables them to present their courses in an orderly and systematic manner, and that they can cover all the material that should be included in such courses. It also provides opportunities to present material that is not always accessible to students. This is particularly true in pharmacy administration because much valuable teaching information is to be found in the drug trade publications and survey reports.

Critics of the student participation plans say that such methods bring about confusion and chaos in the classroom. The more extroverted students ask most of the questions and make most of the comments, and this in time may tend to irritate the other members of the class. While there is good chance that students may get out of hand, it can be said that this will depend on whether or not the instructor is capable of maintaining order. It is noted that some teachers can maintain discipline, others cannot. Those who lack this vital quality are perhaps quite correct in stating that confusion often develops. While it may not be possible to preserve perfect order at all times, the various discussion methods can be defended on the basis that too much freedom is better than no freedom. Successful teaching is based upon the application of intellectual give-and-take, and students tend to be more receptive to learning in an atmosphere that invites their active participation.

Those who favor the discussion methods say that

such plans may limit the amount of material that can be covered in a given course, but that they consider it much more important to concentrate on the vital areas than to cover a multitude of details in a superficial manner. While the straight lecture method may create great student interest if properly conducted, it must be admitted that the presentation of a host of routine details often has a sleep-producing effect second only to the barbiturates.

Some teachers have come to the conclusion that the logical solution to this problem is to teach by a combination of the various methods. It would seem that those of us engaged in teaching pharmacy administration might well use such a plan. Lectures and student participation class meetings could be arranged in such ratio as to do the job most effectively. Or if classes are of small size, each lecture session could be conducted in such a manner as to give the students ample opportunity to express themselves.

The preceding statements are of a most general nature and are intended to be a possible starting point in our deliberations this afternoon. There are, of course, many other aspects of classroom instruction that demand our consideration. It is requested that the participants in this seminar present such problems and information for open discussion. We invite each of you to tell us about your own successes and failures in connection with classroom instruction methods.

PHARMACY ADMINISTRATION

August 17th

"Methods of Classroom Instruction"

Discussion Leader – CHARLES RABE

Discussion of various methods of teaching (lecture, demonstration, discussion, etc. as they lend themselves to the various subjects within pharmacy administration.

Some time spent in re-defining objectives of teaching drug store management. Question debated – Should all phases of management (soda, cosmetics, etc.) be taught or should management be limited to principles?

Comments–

Introduce principles so a person can operate business in profitable manner.

Some thought most phases of management should be taught because income arises from such varied operations.

It was finally agreed that the teaching of sound principles of business was paramount but no accord on scope of coverage.

Some stated they felt extension service work could do much toward improvement of specific phases of management.

Merits of lecture vs. discussion

Comments – Discussions often tend to side track classes but should be overcome through good leadership on the part of the instructor.

Proposal of using case method of teaching. Felt pharmacy had inadequate backlog of cases but in future may develop.

In this discussion there was a great deal of opinionated expression and no definite conclusions were obtained.

OUTSIDE SPEAKERS IN COURSES.

Comments on use of retailers and wholesalers as guest lecturers. Teachers varied greatly in their outlook toward outside speakers. Felt they often did not accomplish purpose of their lecture, and often did not cover specified material.

Generally agreed that occasionally they may be used for sake of public relations but should be consulted in advance as to exact nature of lecture.

Auxiliary Aids

Audio-visual aids as supplements as aids good for salesmanship in supplementing lecture material.

Exhibits and samples find good use in showing various standard forms, licenses, etc.

Movies, slides available from many sources. Literature from wholesalers.

OUTLINES OF COURSES

Agreement that they aid in teaching course and guiding student.

Many blend current literature into course by way of reading assignments in magazines. Problem raised here of library shortcoming at some schools in providing enough copies.

Again mention of dearth of information in administration.

Doctor Blauch made recommendation that administration group in a cooperative project write in sections up-to-date material of sketches of literature. This compiled body of material could easily be reproduced and provided to students at minimal charge. In a sense would provide texts which are so sadly needed.

Methodology of miscellaneous courses

Law

Group discussion very adaptable here

Reading through laws jointly by instructor and student

Some use sample labels to be completed by student and then related to particular laws.

Some use primarily lecture supplemented by some case work and outside reading

ACCOUNTING

Group discussions, class discussions, and laboratory find use. Some don't use formal lab but perform lab function. Agreement that practice situation should be under supervision.

ECONOMICS AND BUSINESS LAW

Lecture best method of teaching.

PHARMACY ADMINISTRATION

August 18th

"Methods of
Demonstration and Laboratory Instruction"
Discussion Leader – W. S. APPLE
University of Wisconsin

(A) *Use of demonstrations in teaching specific courses in administration*

SALESMANSHIP

Use of demonstrations requires very close contact work between student and instructor. In this case great disagreement existed on the point – in teaching salesmanship of a specific product, what should be demonstrated the sale or the product? Question also appeared at this time of whether certain products,

e.g. Rx accessories, should be handled in administration courses or in other areas of pharmacy. Great difficulty too in demonstrating to large classes. The real "how" of demonstrating salesmanship remained dubious although slides, and other visual aids may be superior to verbalization from instructor.

ADVERTISING

In this field the demonstration is very useable. Because of the nature of displays, etc., it is rather difficult to verbalize and hence demonstrations are of tremendous value.

LAW

Suggested that things such as tax stamps, narcotic forms and the like be shown to the student instead of merely telling and explaining.

MISCELLANEOUS

Visual aids cited as tremendous aid in demonstrating material in management such as store locations, Rx files, etc.

Three-dimension slides mentioned as very vivid demonstrators.

SUMMARY

General agreement that demonstrations find much use in the area of pharmacy administration particularly where physical situations or items are to be explained.

(B) *Laboratory Instruction*

In pharmacy administration the laboratory has an entirely different physical connotation than in the other areas of pharmacy.

Accounting is about the only subject which is amenable to a laboratory situation and even here there was no complete accord as to the nature of the laboratory. Many felt that counselling and homework were actually a portion of the laboratory work, and that actually to do laboratory work no laboratory was necessary. Its prime function is to "learn by doing".

At the present there is question as to how extensive should the accounting instruction be. Many schools do not offer a formal laboratory in accounting. Its prime purpose, from our point of view, is to enable a person to make a financial analysis which in turn will become a tool of management. Some feel that this analysis could be taught without the laborious procedures of actual work but most feel that actual doing will facilitate later utilization of financial data.

(C) *Research in Pharmacy Administration*

Because the laboratory function is rather limited in this field compared with the other areas of pharmacy some discussion ensued as to advisability of doing research as a means of combining teaching and laboratory. In this connection the question of using students in these researches was amplified.

Today there is such a dearth of working information in administration that research may be the only means of compiling the data needed for future advancement.

It was generally felt that research projects, if kept to small scale, would benefit the student and pharmacy in general. The student would gain psychic rewards and a grade for participation and facts gained from surveys would, when combined with other facts, give us a working pattern for future decision making.

SUMMARY

The stores and homes could be used as laboratories for small-scale research projects and surveys which would motivate students to understand the course material and equip him to take his place in the profession.

PHARMACY ADMINISTRATION

August 19th

Topic — TESTING

Discussion Leader — P. C. Olsen

(A) *General Considerations of Essay vs. Objective Type Tests*

The discussion leader suggested that pharmacists were rather weak in communication skills and proposed that the essay type of exam would strengthen facility in expression, both oral and written.

The question then arose — How can essay tests be graded? On logic of the answer, composition or both? It was generally felt that without question a sound idea was primary although both should get credit. Some schools have provisions to have service departments handle the composition aspects of exams. The point was also suggested that grading literary efforts under the strain of an exam was not too fair. The group agreed that remedial writing was needed in many fields, not only pharmacy, but how it is to be accomplished is at present unresolved.

The group gave varied sentiment on essay or objective exams. Those with extremely large classes felt that time limitations obviated much essay work and thus minimized expressive skills. At least one individual felt the purpose of the business courses was to teach primary principles and thus utilized objective types primarily.

Mention was made of the great variation in individuals toward the two types of exams. Some are very poor in objective types and vice versa. Proposed that a mixture of the two would offset those handicapped and would afford them an opportunity to show grasp of material.

Some time was spent in discussing persons who have mental blocs and show "freeze-ups" toward exams. In many cases, it was felt, these individuals require personal attention and/or psychological counselling.

The question of weighting of results versus methodology was discussed at great length with no resolution. The group feeling on this matter was extremely varied. On discussing what credit should be allotted to correct answers and how much to methodology the following differences were voiced:

Some placed all emphasis on method, others all on correct answers, and followed a middle-of-the-road policy. Many also expressed the opinion that much of the above decision depended upon specific subject matter and the specific time during the semester, that more liberalness should be shown early in the term with increasing emphasis on answers toward the latter portion of terms and finals.

Many expressed the weakness of many of our students in mathematical skills in reference to use of such skill in discounts, markups, etc. Coaching and person-

al attention was suggested as a possible Rx pricing solution to this.

(B) *Grading of Papers*

It was acknowledged that essay exams are very time consuming. Various individual schemes for facilitation of grading objective type exams were cited.

(C) *Use of Unsolvable Questions*

Discussed the utilization of exam questions which have no specific or perhaps no known answer. Some of group used but placed no merit on them. No agreement as to utility of this type of question.

The following paper is reproduced from the M.C.P. faculty meeting record first because student grand averages are the concern of course teachers, but mainly because the principles of weighted averages apply to evaluation of questions in certain types of examinations, and are used in averaging course components (quiz, lab., etc.) for a final course grade.

GENERAL OFFICE WEIGHTED GRAND AVERAGES IN PROFESSIONAL SCHOOLS

J. H. Goodness
Massachusetts College of Pharmacy

As a rule, a final grade in a school subject (*) is an average derived from such components as recitation, laboratory, and examination grades. Its main function is to establish whether the student has "passed" or "failed" in the subject or course. The professor's judgment is authoritative and his decision usually final.

When all final grades for all subjects taken by a student are collected in the office of the school administrator, he must determine a grand average for such student. This grand average provides a single figure which the administrator and others use as a determinant in making such decisions affecting the student as the following:

1. Promotion to advanced class standing
2. Determination of relative class standing
3. Preparation of a Dean's list or honor roll
4. Awarding scholarships (scholastic type)
5. Selection of applicants for fellowships
6. Determining eligibility for graduate school admission
7. Determining eligibility for society or fraternity membership
8. Affecting recommendations for employment

etc.

Because a grand average is so important, the method used to determine it must be selected with great care. The result must always be fair, impartial, and based upon the soundest human judgment.

Before going further, it may be worth the time to review briefly the meaning of the term "weighted average". As you will recall, *all* averages are weighted averages. The difference being that the weights used on components are either equal or unequal. When equal weights are used, the average is quite commonly but erroneously called "unweighted", while the term "weighted average" most frequently is used to indicate that unequal weights were used on the components.

Since there is no universal standard for *unequal* weights, a standard must be adopted for each specific use. Thus it can be seen that any one of the following could be selected as a system of weights for determining a grand average grade:

1. The value of the course to the job for which the student is preparing
2. The number of clock hours assigned to the course
3. The number of credit hours assigned to the course
4. The attendance record in a course
5. The number of laboratory experiments completed
6. The number of faculty members for a subject or course
7. The tuition for the course

etc.

All of the methods shown above, and many others, are possible methods of course evaluation or weighting even though some are patently illogical. A mathematical basis exists in each even when no justification exists for the use of the method.

In a professional school only the first system – value of the subject or course to the job for which the student is preparing – has a basis of fairness. The degree of fairness present in all other systems mentioned rests upon how closely they approximate the objective of a job-analysis-weight system.

To visualize comparisons of the results of several weighting systems, let us assume that we are dealing with final grades of a student (*) studying first year subjects in a pharmacy school, and construct tables of the student's grades and the grand average for each system. The grades of the student and the statistics of the school program can be assumed to be as follows:

TABLE 1.
STUDENT'S GRADES and SCHOOL PROGRAM STATISTICS

Course number	*Course name*	*Semesters of course*	*Class hours*	*Lab. hours*	*Credit hours*	*Student's final grade*
121	Inorganic chemistry	2	4	3 (s)	10	83
101	Pharmacy	2	2	3 (s)	6	83
161	English	2	3	0	6	77
141	Zoology	1	3	2 (s)	4	82
142	Botany	1	3	2 (s)	4	81
171	Economics	2	1.5	0	3	83
107	Pharm. calculations	2	1.5	0	3	83
106	Pharm.latin	2	1	0	2	85

(s) Assigned value is one "credit hour"

(*) The grades used in the illustration are arithmetical averages of grades of ten students selected at random from a class in a school of pharmacy offering a four year course leading to a B.S. in Pharmacy degree.

(*)Althought this final course or subject grade is a grand average and may be a weighted grade, the discussion here is limited to the grand average as it is determined by the administrator or the general office by combining final grades in all subjects taken by a student. The principles may be applied to subject grades by substituting subject or course components for administrative components such as credit hours, clock hours, etc.

Table 1. provides us with several established criteria for use in weighting and they shall be discussed in turn, except that we may first illustrate the usual method so that we may have a standard for comparison of results. The most common, almost the universal, method is equal weighting, or as it is most commonly expressed, "no weighting".

TABLE 2.

EQUAL WEIGHTS – ARITHMETIC AVERAGE

Course number	*Final grades*	*Equal weights*	*Weighted grades*
(121)	83	1	83
(101)	83	1	83
(161)	77	1	77
(141)	82	1	82
(142)	81	1	81
(171)	83	1	83
(107)	83	1	83
(106)	85	1	85
		8	) 657 (82.12% GRAND AV.

There is much to commend the use of this equal-weight method.

1. It is simple
2. Students can figure their own grand average by what is frequently the only system of averaging that they truly know
3. Interschool grades for transfer students and others can be used without recalculation
4. The judgment of each teacher is given "full faith and credit" evaluation and faculty friction is avoided

The main objections usually made against the use of this method of equal weighting is that no distinction is made by the method between short and long courses, between laboratory and non-laboratory courses, and that the relative importance of each course or subject cannot be considered. There is validity in each of these points.

If a system of unequal weighting can be found which will be more equitable than the equal-weighting method, and which will not substitute new shortcomings for those the new system eliminates, it should be adopted. Perhaps it should be emphasized that in searching for such a system of weights we should be factual rather than emotional, objective rather than subjective, logical rather than merely mathematical, and direct rather than indirect in our judgments. The task is not an easy one.

In general, schools below the college professional school have little or none of the problem of job analysis of student goals. The grammar school prepares for junior high school, which prepares for high school, which prepares for college or work of a non-professional nature. Professional schools, however, must prepare both routine and creative task abilities of their students and therefore grade evaluations should be on a job analysis basis. Unless this is done there is the risk that a system of unequal weighting will be unfair.

Since a job analysis fact finding project is too costly for most professional schools to undertake individually (*) they resort to substitutes, namely various forms of "judgments". These judgments result in such program statistics as are illustrated in table 1.

It may be that these statistics or course evaluations are good for the specific purposes for which they were prepared, but are they valid and fair for the purpose of evaluating students? Let us assume that each set of program statistics shown in table 1. is used separately as a system of weights for the determination of the grand average of the hypothetical student, and note the affect on such grand average.

TABLE 3.

Semesters As Weights – Arithmetical Average

Course number	*Final grade*	*SEMESTERS as weights*	*Weighted grades*
(121)	83	2	166
(101)	83	2	166
(161)	77	2	154
(141)	82	1	82
(142)	81	1	81
(171)	83	2	166
(107)	83	2	166
(106)	85	2	170
		14	) 1151 (82.21% GRAND Av.

This method may be unfair if the semester scheduling for all subjects is not uniform in any year or in different years. Also it is obvious that no relationship need exist between the number of semesters assigned to a course or subject and its clock hours, content, or "value" to the job.

TABLE 4.

Class Hours As Weights – Arithmetical Average

Course number	*Final grades*	*CLASS HOURS as weights*	*Weighted grades*
(121)	83	4	332
(101)	83	2	166
(161)	77	3	231
(141)	82	3	246
(142)	81	3	243
(171)	83	1.5	124.5
(107)	83	1.5	124.5
(106)	85	1	85
		19	) 1552 (81.68% GRAND AV.

This method allows no value to laboratory hours when they are listed separately. If laboratory hours were added to class hours, then laboratory courses would be automatically favored over non-laboratory courses and over courses which used a homework assignment plan which was not listed in the catalog of

(*) The Pharmaceutical Survey, costing about $200,000. and requiring several years of work, is a type of job analysis for the entire profession of pharmacy. When completed it may provide a sound basis for a pharmacy school curriculum, and indirectly, if it is sufficiently detailed, a basis for a system of weights for pharmacy school subjects.

(The Pharmaceutical Survey did not produce sufficiently detailed information upon which to base weights for separate subjects. J.H.G.)

the school. Inequities would also arise if no distinction was drawn between class hours devoted to lectures, quizzes, field trips, movies, etc. And finally, to be consistent, attendance would have to be made compulsory upon penalty of loss of grade for absences, for class hours are the basis of weights.

TABLE 5.

Laboratory Hours As Weights – Arithmetical Average

Course number	*Final grades*	*LAB. HOURS as weights*	*Weighted grades*
(121)	83	3	249
(101)	83	3	249
(161)	77	0	0
(141)	82	2	164
(142)	81	2	162
(171)	83	0	0
(107)	83	0	0
(106)	85	0	0
		10	) 824 (82.40% GRAND AV.

Laboratory hours cannot be used as weights in a school where both laboratory and non-laboratory courses and subjects are part of the same curriculum, for the latter would receive no weight whatsoever in the grand average. Also subjects requiring laboratory work which is not listed in the catalog, because such work is not regularly held, would be overlooked.

It is interesting to note that the grand average in the above illustration does not differ materially from grand averages figured on all courses. The reason lies in the fact that the final grades of the hypothetical student are relatively close in value for both the courses weighted and those not included in the weighted average.

TABLE 6.

Credit Hours As Weights – Arithmetical Average

Course number	*Final grades*	*CREDIT HOURS as weights*	*Weighted grades*
(121)	83	10	830
(101)	83	6	498
(161)	77	6	462
(141)	82	4	328
(142)	81	4	324
(171)	83	3	249
(107)	83	3	249
(106)	85	2	170
		38	) 3110 (81.84% GRAND AV.

A "credit hour" is an artificial time-unit having no uniform relationship to clock time. It is used for comparative evaluation of clock hours spent in different types of educational activity, the same activity by different categories of students, and for purposes of determining tuition costs. Thus for the purposes of the first two items, one credit hour may represent any one of the following:

1. One hour of lecture
2. One hour of recitation or quiz
3. One hour of laboratory (Mammalian anatomy)
4. Two hours of laboratory (Botany and Zoology)
5. Three hours of laboratory (Pharmacy or Chemistry)
6. One hour of lecture for undergraduate students or one hour of lecture with one hour of laboratory for graduate students (Economic Biology) Etc.

A credit hour is so variable from an educational point of view that it cannot be used as a system of weights for the courses. As some evidence of this point, consider the credit hours assigned to the subjects in table 1., and see if you are willing to accept the following equations which would result if a job analysis basis was used for your judgment:

1. Botany is equal in value to zoology
2. Pharmacy is equal in value to English
3. English is twice as valuable as economics
4. Chemistry is equal in value to both pharmacy and botany combined
5. Two hours of botany are equal in value to three hours of pharmacy

etc.

If we examine the use of the method further we could find that it is highly probable that students will give disproportionate time to "high value" subjects with probable detriment to those subjects rated as "low value" subjects. Such a practice would unduly favor some students, particularly if such students could not or would not maintain fairly consistent grades in all courses. An illustration of three sets of final grades will enable us to see this quite clearly.

TABLE 7.

EFFECTS OF FAVORING AND DISFAVORING A HIGH "CREDIT-HOUR" COURSE

Student:	X			Y			Z		
Course number	*Final grades*	*CRED. HR. weights*	*Weighted grades*						
	(a)	(b)	(c)	(a)	(b)	(c)	(a)	(b)	(c)
(121)	80	10	800	94	10	940	61	10	610
(101)	80	6	480	75	6	450	80	6	480
(161)	80	6	480	75	6	450	80	6	480
(141)	80	4	320	75	4	300	80	4	320
(142)	80	4	320	75	4	300	80	4	320
(171)	80	3	240	75	3	225	80	3	240
(107)	80	3	240	75	3	225	80	3	240
(106)	80	2	160	75	2	150	80	2	160
		38	) 3040		38	) 3040		38	) 2850
GRAND AVERAGE:		X = 80.00%			Y = 80.00%			Z = 74.40%	

It is interesting, perhaps disturbing, to note that student Y by dropping 35 points through seven subjects, but by increasing by 14 points the grade earned in a "high credit-hour" subject equalled the grand average given to X, an obviously superior student. And that Z by dropping 19 points in one subject is "failed" in the grand average although he received 80's in seven subjects, and was "almost the equal" of X.

And finally, the adoption of the "credit-hour" system as a system of weights could lead to other very undesirable results in a school. This would be especially true if the teachers in courses given high credit-hour ratings used the credit-hour values as an index of their political power in faculty meetings, as a basis of salary determination, or for other self-rating purposes.

If for no other reason than their mathematical complexity, geometric and harmonic systems of weighting will be avoided by school administrators.

To facilitate comparison of the grand averages as derived by the systems or methods discussed, the following table is prepared:

TABLE 8.

SUMMARY OF GRAND AVERAGES AS FIGURED BY ILLUSTRATED METHODS

(From table 2) Equal weights	82.12%
(From table 3) Semesters as weights	82.21%
(From table 4) Class hours as weights	81.68%
(From table 5) Laboratory hours as weights	82.40%
(From table 6) Credit-hours as weights	81.84%

The approximate equality of the grand averages must not be taken as proof that equally sound judgment is evidenced by the use of each weighting system, for even a slight fractional difference between student grand averages places each at different points in a list of the great and the weak.

CONCLUSION: Until such time as a reliable job analysis of pharmacy is available, upon which at least a majority of educators can agree, and upon which a syllabus of values for courses can be constructed which is agreeable to the majority, it is advisable to continue in the use of equal-weight grand averages, when they are to be used for the purposes enumerated in the introduction.

Professional Orientation Section

ABSTRACT OF THE PROCEEDINGS

Evening sessions on August 16 and 18 were devoted to the area of instruction included under "Professional Orientation" in Blauch and Webster's *The Pharmaceutical Curriculum* (excepting the course in public health). Glenn Sonnedecker of the University of Wisconsin had been invited to arrange a program concerning this segment of the curriculum, which has not been developed in the schools as uniformly as have the technical and scientific courses in the curriculum. Because of the relative lack of agreement on the necessary extent and aims of such instruction, the workshop was designed to develop common understandings of the objectives, content, and place in the curriculum for "professional orientation" courses.

The need for an exchange of ideas and experiences in this field was evidenced by the attendance at both workshop sessions, which was much larger than expected. Although the proceedings were not transcribed, the following material and summary of the discussions as a part of the Seminar record, should be helpful to teachers who could not attend.

Tom D. Rowe of the University of Michigan presided over the first session.

INTRODUCTORY REMARKS

GLENN SONNEDECKER
University of Wisconsin

We welcome you to the Professional Orientation Workshop. Our discussion hinges on the assumption that every graduate should be well orientated professionally. You would like to say of every one of your former students: "He is a good pharmacist." This does not necessarily follow from a good scientific education alone. How often, when a young pharmacist does not quite measure up, must we admit that the professional infirmity has its roots elsewhere than in a lack of technical or scientific knowledge? This reminds us of Dr. Elliott's conclusion that one of American pharmacy's primary needs is "a far greater proportion of members who are ever sharply jealous of the high reputation of the profession and who, by energetic cooperation, are determined ever to protect that reputation."

Now it would be foolish to believe that, through a course or two, the magic of education will exorcise all the problems of personality, economics, and workday environment that sometimes conspire to keep our ideals from becoming realities. I think it equally unwise to believe those who maintain that the professional orientation we have in mind must be "caught rather than taught."

That is a nice phrase; and in one sense there is something to it. But we dare hope — and in fact assume — that the whole educational experience helps mold a man to the pattern of abilities, ideals and attitudes we recognize as a "good pharmacist." That raises a question: Can we rely alone upon occasional intrusions of humanistic and social concerns into scientific courses and upon the inspiration stemming from social relationships between faculty and students? Without minimizing this influence of the total environment of the pharmacy school on the student's professional orientation, Blauch and Webster suggest the importance of several courses to be taught under this general heading.

These courses form the topical framework of our Workshop. Most schools now offer some such instruction. But the interest in it is almost matched by the uncertainties. The field is wide open for discussion; and we have been cautioned not to focus too much attention on methods until we have a clearer idea (a consensus, I hope) concerning the objectives, content and place in the curriculum for instruction embraced by the term "professional orientation."

The subject was introduced and ably explored in the first part of the discussion session on Pharmacy this afternoon, as far as time permitted. We shall assume you were there and shall proceed with as little duplication as possible. It seemed that our thinking might best be clarified by systematic discussion of course topics as presented by Blauch and Webster. We have asked for short informal talks from a few teachers known to be doing an effective job. I hope others who have had valuable experience — unknown to us— will take an equally active part. Above all, we hope everyone will freely contribute questions or answers, and frank and informal comments. Here we are all students as well as teachers. May we learn how to help the young pharmacist to apply his knowledge responsibly and with dignity, effectively and with enthusiasm, imaginatively and with rich understanding of his role in the community and the place of his profession in society.

The ensuing discussion, under the leadership of Dean Rowe, centered about two topics: (1) pharmacy orientation for beginning students, and (2) professional communications.

PHARMACY ORIENTATION FOR BEGINNING STUDENTS

Tom D. Rowe of the University of Michigan had been invited to make a semi-formal presentation describing an experimental course in freshman orientation developed by him and his colleagues. His introductory talk follows:

INTRODUCTORY PHARMACY AT THE UNIVERSITY OF MICHIGAN

Tom D. Rowe
University of Michigan

In September, 1953, we introduced at Michigan a completely different course, for us at least, in beginning pharmacy. Perhaps other schools are using an approach similar to ours, but as far as we know they are not.

We had been teaching for years the usual Introductory course covering essentially the material presented in Part I of Volume I of American Pharmacy — namely Fundamental Principles and Processes. We had become increasingly dissatisfied with the course because we felt (1) The material covered was to a great extent unimportant and too elementary. The parts that were important could be included in other courses on a higher level; (2) The students were not getting a proper introduction into pharmacy and were often bored with the information presented.

We decided to scrap the entire course, get a fresh approach and start all over again. A committee of four faculty members was appointed to plan a new course. This group met weekly for at least two hours over a period of five months. At the end of that time a new course had been outlined and the general procedures to be followed were ready. The most important of these were:

(1) The course content was built around the fields of pharmacy — retail, wholesale, manufacturing, hospital, etc. Specific periods of time were allotted to each field with largest segment — six weeks — being devoted to retail pharmacy (see Timetable). The idea of using this approach was to give the students an overall picture of pharmacy and have them develop some general concepts concerning the profession. Detailed information and innumerable facts were not wanted.

(2) No lectures were to be given. The beginning group of about 60 were to be divided into four discussion sections of 15 each with experienced teachers in charge of each section. Three full professors and one assistant professor were assigned these sections.

(3) Insofar as possible field trips were to be used as means of demonstrating the subjects to be covered. A total of 7 half-day field trips were provided for.

(4) The arithmetic of pharmacy was to be given in conjunction with the field of pharmacy it was most closely related to. For example, reducing and enlarging of formulas was discussed when manufacturing pharmacy was considered, commercial discounts, etc., were under wholesaling.

(5) Every effort was to be made to have the students participate actively each week in the sections to which they had been assigned. We wanted, among other objectives, to help teach the students to think rather than memorize.

In carrying out these general policies two important procedures were followed:

(1) Each week the students were given an assignment sheet (samples reproduced below). In addition to the assignment for the next week, there were included a terminology list covering the section of the field being studied and a list of study questions. In addition to these sheets supplementary study material was usually given out. Most of this study material had been prepared by the faculty members.

(2) Weekly meetings of the teachers of the course were held. These were generally a day or two after the weekly class meeting. At these sessions, preparations were made for the next class including discussion of the instructors outline to be followed. These had been prepared by the teacher responsible for a given area. For example, the teacher in charge of preparing material for retail pharmacy also prepared the teachers' outline for retail pharmacy. This procedure enabled the four teachers to have a fairly uniform basis for discussion.

Also at these sessions, the weaknesses and strong points of the previous class meeting were considered. Notes were made on changes and improvements to be included the following year.

The results of this course were most satisfactory. We felt it to be a great improvement over the work we had been giving previously. Being a new course, we found a lot of "bugs" in it, many of which will be corrected next year. Perhaps the most important change will be the addition of one clock hour per week. This extra hour was found to be necessary because of the extensive student participation in the discussion sections. We found that it was difficult to stop discussion at the end of the first hour of the two-hour period and take up the arithmetic during the second hour. No extra credit will be given for the additional hour of discussion.

We believe the freshmen have a better overall understanding of the profession of pharmacy after this course than our seniors previously had. We believe the students learned to do some original thinking. Perhaps one measure of the success of the presentation comes from students who had failed the old course the previous year and were required to take the new course. Without exception those students voluntarily expressed opinions that they felt the new approach was much, much better than the old.

We are now in the process of remodeling our sophomore courses in pharmacy. While the same approach cannot be carried out to such an extent in these we do expect to put more emphasis on concepts and original thinking and less emphasis on facts and memory work. Eventually we hope to revise all of the pharmacy courses along similar lines.

Rowe then distributed the following samples of material used in the course (Pharmacy 3 and 4): (1) Time Table and topical outline, (2) lesson outline sheets for two typical assignments, and (3) a final examination for the first semester. This material is reproduced below.

UNIVERSITY OF MICHIGAN
PHARMACY 3 and 4
INTRODUCTORY PHARMACY

Time Table, Topical Outline, and Materials

Pharmacy 3: First Semester

First Week : Introduction of teachers of course. Informal discussion among teachers of objectives of course and the general method of procedure throughout the year. Continuation of discussion with students.

1. Schedule for the semester.*
2. Biographies of teachers
3. Objectives of the University, the College and the course.
4. "Shall I Study Pharmacy" brochure
5. Sheets of simple prescriptions
6. Selected references in Kremers and Urdang bearing on retail pharmacy

Second Week: Discussion of the successful pharmacist, the prescription, historical development of retail pharmacy in America, types of medicinal products. Discussion of the metric system and common systems of measurement. Briefing on types of retail pharmacies in Ann Arbor preparatory to field trip the following week.
1. List of stores in Ann Arbor
2. Map of the city
3. Outline of development of retail pharmacy

Third Week: Visits to eight retail pharmacies in Ann Arbor, each showing a different type of establishment. Preliminary arrangements are made with each store and the proprietor spends about 20 minutes showing the students the establishment and discussing with them any particular features which the store exemplifies especially well. He also answers questions asked by the students.

Fourth Week: Associations and journals of particular interest to retail pharmacists. Introduction to conversion.
1. Code of Ethics, A. Ph. A.
2. Selected references in the General Report of the Pharmaceutical Survey
3. Selected journals

Fifth Week: Discussions of associations and journals. Problems on conversion. Introduction to manufacturing and control. Discussion of Code of Ethics.
1. Selected materials in Kremers and Urdang on manufacturing
2. A visit to Parke-Davis and Company

Sixth Week: Examination on arithmetic and on retail pharmacy.

Seventh Week: Discussion of examination. Nature and development of pharmaceutical manufacturing problems in conversion. Introduction to problems in reducing and enlarging formulas. Reference to U. S. P. conversion tables.
1. Outline of manufacturing pharmacy

Eighth Week Visit to College of Pharmacy laboratories in Manufacturing Pharmacy and in Analytical Pharmaceutical Chemistry. Discussion of concepts of accuracy and of control in manufacturing. Briefing for visit to manufacturing plant.

Ninth Week: Visit to manufacturing plant in Detroit.

Tenth Week: Discussion of visit to College of Pharmacy Laboratories and manufacturing plant. Summary of manufacturing and control. Associations and journals devoted to manufacturing and control.
1. Outline of wholesale pharmacy

Eleventh Week: Examination on manufacturing pharmacy and control, and arithmetic.

* Numbered items indicate printed or mimeographed material furnished to students.

Twelfth Week: Nature, history and services of wholesale pharmacy. Introduction to problems in discount. Briefing for visit to wholesale establishment.
1. Literature from wholesalers

Thirteenth Week: Visit to wholesale establishment in Detroit.

Fourteenth Week: Discussion of visit to wholesale establishment. Additional problems of a commercial nature. Briefing for demonstration by Medical Service Representative.
1. Selected samples of manufacturer's literature

Fifteenth Week: Demonstration of a typical detail visit to a physician by a Medical Service Representative. Discussion of the objectives and techniques of the detail visit and distinctions between it and a sales visit. Estimation of doses for children.

Sixteenth or Seventeenth Week: Three hour final examination on fields in pharmacy and on arithmetic used in these fields.

Pharmacy 4: *Second Semester*

First Week: Introduction to history and practice of Hospital Pharmacy. Review of final examination of Pharmacy 3.
1. Outline of development of Hospital Pharmacy in the United States
2. Minimum standards

Second Week: Discussion of Hospital Pharmacy. Problems in dosage. Introduction to percentage problems. Briefing for visits to local hospital pharmacies.

Third Week: Visits to pharmacies of St. Joseph's Hospital, University Health Service, Outpatient Clinic, and University Hospital.

Fourth Week: Discussion on local hospital pharmacies, associations, and journals of interest to hospital pharmacists. Percentage problems.
1. Outline of government pharmacy

Fifth Week: Discussion of pharmacy in branches of government. Visit to V. A. Hospital: pharmacy, laboratories, and central service.

Sixth Week: Examination on Hospital and Government Pharmacy and on arithmetic: dosage and percentage.
1. Outline of Drug Standardization

Seventh Week: Discussion of U. S. P., N. F., N. N. R. and Drug Standardization. Display of revision of U. S. P. and N. F. Percentage problems.
1. Outline of laws affecting pharmacy

Eighth Week: Discussion of legal officials and consultants: national, state, and private. N. A. B. P.; State Boards. Introduction to alligation.
1. Outline of pharmaceutical education
2. History of University of Michigan College of Pharmacy

Ninth Week: Discussion of pharmaceutical education. Slides of colleges. A. A. C. P.; A. C. P. E.; A. F. P. E. General arithmetic problems.

Tenth Week: Discussion of graduate education in pharmacy, research. Briefing for visits to University research laboratories. General arithmetic.

Eleventh Week: Visits to College and other University Research Laboratories in Pharmacology, Pharmacy,

and Physics.

Twelfth Week: Examination on fields and arithmetic.
1. Outline of administrative fields in pharmacy

Thirteenth Week: Discussion of administrative work in pharmacy: college, association, and industrial. General arithmetic.

Fourteenth Week: Discussion and examination of pharmacy, journals: scientific, abstract, review, association, trade, and house organs. Discussion and examination of manufacturer's literature.

Fifteenth Week: Presentation on inter-professional relationships.

Sixteenth or Seventeenth Week: Final examination.

Notes: a. Each week a list of questions and terminology is furnished each student.
b. No formal lectures are given in the year's course. Almost all instruction is by discussion, demonstration, field trips, or visual materials.

OUTLINE FOR MARCH 17, 1954
PHARMACY 4

First hour (2:10): Sections meet for 1-hour examination on pharmaceutical calculations.

Second hour (3:10): Sections meet for discussion of arithmetic assignment due March 17, and of examination.

Assignment for March 24: Drug Standardization.

1. Study outline: Drug Standardization in the United States.

2. Examine U. S. P. XIV, as well as earlier revisions of the U. S. P., noting Board of Trustees, Committee of Revision, Subcommittees, Additional Committees, Preface, History, and nature of individual monographs. (L)

3. Examine N. F. IX, as well as earlier revisions of N. F., noting Council of the A. Ph. A., Committee on National Formulary, Subcommittees, Preface, History, General Principles, General Notices, and nature of individual monographs. (L)

4. Nomenclature:

official	NNR	drug
unofficial	admission	Standards
pharmacopeia	deletion	tests
formulary	scope	titles

5. Review questions:

(1) The U. S. P. XV and the N. F. X will not contain Latin titles except for those drugs whose Latin name is quite different from the English name (e. g., Rheum for Rhubarb). Compare this policy with the policies of the two books in the early 1900's and for U. S. P. XIV and N. F. IX. What is your opinion of the relative merits of the three policies illustrated in the official books of the early 1900's, 1950, and the ones currently being revised.

(2) The Codex Mendicamentarius Gallicus (French Pharmacopeia) is revised and published in the Ministry of Public Health, a governmental department. Contrast this practice with that prevailing for the U. S. P. and N. F., and state which procedure you believe to be best, with reasons for your answer.

(3) Why do we have two (U. S. P. and N. F.) principal official books of drug standards?

(4) Do you believe it would be better to have but one book of drug standards in the United States? Explain the reasons for your answers.

(5) In a majority of our states pharmacists are required by law to have in their stores copies of the latest U. S. P. and N. F. Many resent this requirement because they claim they rarely use the references in compounding. Do you think the requirement is fair or not, and why?

(6) Compare and contrast the U. S. P. and the N. F. with respect to origin, scope, legality, control, and revision.

(7) What useful functions are fulfilled by N. N. R. and what relations does it bear to the official books of drug standards?

6. Pharmaceutical Calculations: pp. 166-168, numbers 42, 43, 44, 50, and 66.

OUTLINE FOR MARCH 24, 1954
PHARMACY 4

First hour: Visit display showing mechanics of revision program of U. S. P. and N. F., Pharmacognosy laboratory, Schedule: Sect. 1 (Dr. Deno), 2:10; Sect. 2 (Dean Rowe), 2:30; Sect. 3 (Dr. McConnell), 2:50. Balance of first hour for each section on discussion of assignment made March 17 for March 24: Drug Standardization.

Second hour: Continuation of discussion of Drug Standardization. Pharmaceutical Calculations: pp. 166-168, numbers 42, 43, 44, 50, and 66.

Assignment for March 31: Legal Officials and Consultants.

1. Part III of bulletin "Inside the Home Medicine Chest", pp 13-22 incl.

2. Be able to explain terminology and answer review questions given below.

3. Calculations: Study pp. 153-161. Work problems on pages 167-173, numbers 14, 19, 20, 35, 56, 67, 69, 89, 95, 115.

Terminology

F. D. A.	New Drug
N. A. B. P.	Dangerous Drug
F. T. C.	Narcotic
State Board	Exempt Narcotic
Pharmacy Internship	Fair Trade

Study questions:

1. What are the major improvements of the F. D. C. law of 1938 over that of 1906?

2. How is it possible that there can be a federal law which restricts the sale of drugs within the states when this activity is generally considered to be within the province of state regulations?

3. As long as the Federal law is so complete why do states enact their own food and drug laws patterned after the Federal law?

4. Assume that Mr. Jones thinks he has found a new herb which has wonderful curative properties for cancer. Can he put it on the market without restriction? What procedure would he have to follow in order to get it on the market?

5. In recent years there have been a number of cases brought to court for the purpose of restricting the sale of drugs (other than certain proprietaries) to drug stores. If you were an attorney for the non-drug store outlets, what arguments could you give for permitting the sale of drugs outside of drug stores. What arguments could you give for the other viewpoint — i. e. — restrict sales to pharmacies.

6. In general what do state pharmacy laws cover that is not covered in Federal drug laws?

7. What is the sociological importance of the Harrison Law?

FINAL EXAMINATION

PHARMACY 3 Part 1 Jan. 28, 1954

1.

"Smith's Drug Store (owner, John Smith) is a neighborhood-type store, with soda fountain, the usual sidelines of such stores and a small but steady prescription business. "Brown's Ethical Pharmacy" (owner, George Brown) is an exclusive prescription pharmacy, with no fountain, no sidelines other than sick-room supplies and high quality cosmetics, and a large prescription business. Two friends of Smith and of Brown agreed that Smith ran a more ethical establishment than Brown. How is this point of view possible?

2.

In many states, pharmacists are required by law to own accurate sets of weights in the metric system, in the apothecaries system and in the avoirdupois system. Explain in detail the logical reasons for this requirement.

3.

If you were a practicing pharmacist in Ann Arbor (or city of comparable size) what professional and what other organizations would you belong to and why? Are there any such groups that you would not join, and if so, why?

4.

A rather elaborate system of checks or controls is used in manufacturing a product on a large scale, while a simple system is sufficient for preparing the same product in a retail pharmacy. Why is the more elaborate system of control necessary for the manufacturer?

5.

After a long period of relatively slow growth, manufacturing pharmacy has grown rapidly in the United States since 1900. Can you explain this sudden growth?

6.

Assume you live in an area served by four different wholesale druggists. How would you determine which of these firms you would prefer to do business with? Do not include the item of personal friendliness with the representative or an executive of the wholesale house.

7.

Rx
Neoferratose 0.60
DTD caps No. C
Sig. One after each meal

This prescription was presented to pharmacist Jones by a regular patron. He did not have Neoferratose, had never heard of it, and was unable to find it listed in any of the standard references on pharmaceutical specialties. He was about to telephone the pharmaceutical service department of his nearby wholesaler when he decided to check the New Prescription Products Index of the December number of the Pract. Pharm. Edit. of the Journal of the A. Ph. A., just received. Here he found Neoferratose listed, a new product of Smith and Brown, a relatively small pharmaceutical manufacturer in Cleveland. The Smith-Brown representative, who combined medical service representation with sales work, usually called every three months, and his visit was then due.

Mr. Jones explained to his patron that the prescription called for a recently developed drug and that he would secure the item that day if possible but no later than the next day and deliver the prescription. This was satisfactory. He could not get the drug from local fellow-pharmacists because none had it in stock, so he telephoned the wholesaler, who mailed the item by first-class mail so it was received the next morning and the prescription delivered before noon. The Smith-Brown representative called the afternoon of the second day, and before placing his order, pharmacist Jones (in a gentlemanly way) gave the representative "a piece of his mind" on the evils of getting carts before horses.

a. In the Rx what are the directions to the pharmacist?
b. What progressive, relative modern features of the services rendered by wholesalers are illustrated or mentioned here?
c. What are the standard services of drug wholesalers?
d. What is meant by "combined medical service representation with sales work"?
e. What "piece of his mind" did pharmacist Jones probably give to the representative?
f. What practice characteristic of good relations of the pharmacists to fellow pharmacists is suggested here?

The Michigan presentation stimulated a vivid discussion. There was considerable enthusiasm for a beginning course of this type, although some felt it would be prohibitively expensive in staff time. Rowe felt, however, that the results were justifying the effort invested in the course.

Sonnedecker commented that a two-credit course along similar lines had been developed at Wisconsin, with less staff and probably with correspondingly less effectiveness. The Wisconsin course is given primarily by a single professor, instead of four, and the class is not divided into small discussion groups. Metrology is not included. Instead, instruction and guidance are offered in study methods and in preparing for and taking examinations. This segment of instruction, still in an experimental stage, grew from the feeling that too many pharmacy students were working considerably below their potential. The University's Student Counseling Center cooperates in this part of the instruction. Sonnedecker pointed out that freshman field trips were partly replacing classroom visual aids, following the lead of Michigan.

The following outline of the Wisconsin course was distributed to participants in the workshop:

The University of Wisconsin

OUTLINE OF "ORIENTATION IN PHARMACY"

Pharmacy 1A (First Semester)

Period 1-3: Study methods; preparing for and taking examinations; counseling services.

Period 4: Student life and motivations; pharmacy students of other states and nations; the graduate a teacher likes to recommend.

Period 5: Scope and nature of pharmacy; the student's professional heritage — a historical stage setting.

Period 6: Pharmacy a diverse and changing field; services of pharmacists, past and present; the anatomy of U. S. pharmacy; relation to other professions.

Period 7: Field trip to a retail pharmacy.

Period 8: Discussion of retail pharmacy. Career opportunities; job analysis; employment and economic outlook; advantages and disadvantages; education, experience and personal characteristics needed.

Period 9: Field trip to a hospital pharmacy.

Period 10: Discussion of hospital pharmacy (analogous to No. 8).

Period 11: Field trip to a wholesale druggist.

Period 12: Discussion of the wholesale drug field.

Period 13: Field trip to a manufacturing laboratory.

Period 14: Discussion of manufacturing pharmacy; new drug development. Additional types of employment possibilities for the pharmacist.

Period 15: Examination.

Pharmacy 1B (Second Semester)

Period 1: Pharmaceutical law — its social significance. Food and drug, narcotic, poison and other legislation.

Period 2: State pharmacy practice act. The internship — nature, purposes and regulations

Period 3: Ethics (vs. law) — social and professional implications of self-discipline.

Period 4: Professional oaths and codes; the American Pharmaceutical Association's Code of Ethics.

Period 5: Professionalism and fraternalism through association. American pharmaceutical organizations; societies in related fields. International organizations (including student federation).

Period 6: Student organizations.

Period 7: Functions of professional education; how it affects the status and character of pharmacy. Changing conditions ask for changing educational patterns. How a pharmacy school functions; standards and policies. The teacher and the student.

Periods 8-10: Introducing the faculty; branches of undergraduate study, their objectives and importance for the student's vocational goal; graduate study.

Period 11: Tour of the School of Pharmacy* and its library.

Period 12: Tour of the main University library.

Periods 13-14: Literature of pharmacy; effective use of the library; how the librarian can help.

Period 15: Examination.

* Intended to stimulate interest in, and understanding of, the School of Pharmacy, since freshmen at the University of Wisconsin are in the College of Letters and Science (pre-pharmacy).

A question was raised concerning the omission of fundamental principles and processes of pharmacy, which has been more or less traditional in many freshman orientation courses. The concensus of those who commented seemed to be that such instruction could well be incorporated later in the curriculum, preferably after physics if at all — although there was no agreement on this point.

Karl L. Kaufman of Butler University and Ralph Clark of the University of Oklahoma both took part in the discussion and distributed outlines of their courses, which are reproduced below:

Butler University

ORIENTATION IN PHARMACY

PHARMACY 100

Didactic — 1 Credit hour
Instructor — K. L. Kaufman

1. *Objectives*:
   - A. To acquaint new and prospective students with background information regarding the origins and present status of Pharmacy.
   - B. To acquaint the student with the varied opportunities provided by the profession.
   - C. To begin the indoctrination of the student with the ideals of a professional person.
2. *Text*:
   - A. None required.
3. *References*:
   - A. Code of Ethics, A. Ph. A.
   - B. No other reading required
     1. Current articles and books frequently cited
4. *Outline of Lectures and Discussion*:
   - A. First period
     1. General introduction to series
     2. Statement of objectives
     3. Instructions to class
     4. Difference between training and education
     5. Attitudes, right and wrong
     6. Classroom etiquette
   - B. Second period
     1. The historical background of pharmacy
        - a. Medicine, magic and Religion in primitive times
   - C. Third period
     1. Ditto
        - a. Brief summary of development of the sciences through the ages
   - D. Fourth period
     1. The place of the Humanities in the Development of the Scientist-Guest Lecturer
   - E. Fifth period
     1. Admission requirements and regulations
        - a. University
        - b. Pharmacy College
     2. The cost of a University education
        - a. Direct
        - b. Indirect
          - (1) Sources

(a) Need for continued exploration and development

F. Sixth period
1. Student mortality in—
Universities
Pharmacy Colleges
a. reasons
2. The four types of "Rulers" which govern the Pharmacists and other professional men
a. Legal
1. Federal, State and Local
b. Educational
1. University, A.C.P.E., College, State Board
c. Conscience
1. The mark of a truly professional man
d. Miscellaneous
1. Other professions

G. Seventh and Eighth periods
1. The "Whys" of the Pharmacy Curriculum
a. The two-fold purpose of the educational program
(1) As a pharmacist
(2) As a citizen
2. Why be interested in the humanities?
a. Shortcomings of our curriculum
(1) Professional and scientific courses which, in part, can broaden our background
3. The objectives of the undergraduate program
a. cf. "Pharmaceutical Survey, General Report," p. 229

H. Ninth period
1. Education for professional responsibility
a. Comparison of stated objectives for Pharmacy with those of:
(1) Law
(2) Business
(3) Engineering
(4) Ministry
(5) Science
b. Are our objectives right?

I. Tenth period
1. Ethics: Professional vs. Market Place Variety
a. The meaning of ethics
2. Is Pharmacy a profession or a business?
a. What is the difference?
b. Examples:
(1) Advertising, types of
(2) Professional activities, development of
3. Caveat emptor or Caveat actor attitude?

J. Eleventh and Twelfth periods
1. The Numbers and Occupations of Pharmacists
a. Retail
b. Hospital
c. Manufacturers
d. Wholesalers
e. Service representatives
f. Teaching and government
g. Other capacities

K. Thirteenth period
1. Organizations of Pharmacy
a. Eighteen national organizations listed and briefly described
2. The problem of getting unity
a. National Drug Trade Conference
(1) Value and shortcomings

L. Fourteenth period
1. The State associations
a. Mode and date of origin
b. Some functions of the I. Ph. A.

M. Fifteenth period
1. The laws of Pharmacy
a. History and purposes of principal laws briefly described

N. Sixteenth period
1. What should the Pharmacist be?
a. Qualifications (Charters report)
b. Emphasis on character traits
2. "Your future in Pharmacy depends on you."

O. Seventeenth period
1. General Summary and Conclusions

5. *Examinations and Reports*:

1. Weekly reports covering the essential data given in the last class meeting are required. Grades are based upon the completeness, accuracy and promptness of these reports.

2. "Final Examinations" consists of statement written by the student in which he has the opportunity to criticize any factual data he has heard, and in which he is urged to tell what he feels should be added to or deleted from the material given. The statement may be left unsigned.

General Notes.

1. These talks are not intended as a "whitewash" of the profession. Shortcomings are revealed and discussed.

2. Discussion is encouraged at every meeting.

PHARMACY 7 ORIENTATION

First Semester 1953-54

Tuesdays-Thursdays — 8:00, Ph. 310

Instructor — R. W. Clark

University of Oklahoma

Objective—

To introduce the student to pharmacy by presenting parts of the profession which, when put together in detail in later courses, make up the total academic education for a health profession. The curriculum, the use of the library, historical development, pharmaceutical literature, organizations, business and professional ethics and the opportunities, problems and limitations in pharmacy are presented. Lectures are given for one period each week; a class discussion of the lecture and supplementary assignments in the text and elsewhere also takes place one period per week.

Text—

Fundamental Principles and Processes of Pharmacy, Burlage, Burt, Lee, Rising. pp. 1-132, Second edition, McGraw-Hill.

Outline of the Course—

Week of:

Sept. 14—The regulations and courses in the curriculum, emphasis on sequence, prerequisites and reasons for various courses are given.

Sept. 21—Historical Development, Ancient to American Colonies.
Sept. 28—American Colonies to Civil War
Oct. 5—Civil War to Present
Oct. 12—Examination, October 13, 1953
Oct. 19—The Use of the Library
Oct. 26—The Literature of Pharmacy — Pharmacopoeias, Commentaries, Text Books, Journals. U. S. P. Monograph in detail.
Nov. 2—The Pharmacist and Society — as a public servant; his contribution to literature, science and industry
Nov. 9—Organizations in Pharmacy — Economic Structure
Nov. 16—Developing an Education—Colleges, Curricula.
Nov. 23—Examination, November 24, 1953.
Nov. 30—Ethics — Religious Aspects — Guest lecture in cooperation with Religious Emphasis Week.
Dec. 7—Professional — A. Ph. A. Code of Ethics
Business Ethics
Dec. 14—Examination, December 17, 1953.
Jan. 4—Current business and professional regulations
Jan. 11—Present Status (Survey)
Opportunities and Limitations
Final Examinations

The consensus seemed to be that there was a substantial content available for a beginning orientation course, which had a worthwhile place in the curriculum. Two semester hours might be devoted to it as a required course. Present instruction is usually given to first-year students; but it may not be administratively practicable at some schools to give the course to pre-pharmacy students in extended curricula.

The trend of discussion placed primary emphasis upon analyzing contemporary pharmacy in its various aspects; introducing the student to pharmaceutical literature and library work; and orienting him to college life and studies. Varying stress was placed upon using beginning orientation to introduce professional ethics and the history of pharmacy. It was agreed that field trips were worth the additional expense and effort required and that class discussion in small groups would enhance the value of such a course substantially.

PROFESSIONAL COMMUNICATIONS

The second part of the first workshop session was devoted to instruction in "professional communications", in the sense discussed by Blauch and Webster in *The Pharmaceutical Curriculum* (pp. 158-161). The unexpectedly extended discussion apparently reflected an attractive idea and a need, rather than experience with such a course. Moreover, the consensus seemed to be that there was little prospect of a widely taught separate course in this field, except possibly as an elective.

There was keen interest in the objectives represented: proficiency in acquiring pharmaceutical information from various sources; ability to evaluate and organize it; and skill in expressing it effectively in written or oral form.

Rowe described a plan being developed at the University of Michigan aimed at reaching part of this objective. All students would be required to prepare at least one term paper each year, in connection with some existing course in the pharmacy curriculum.

Sonnedecker reported that there had been particular concern at Wisconsin because of deficiencies among graduate students in ability to express their ideas and laboratory findings in a lucid and correct way. Remedial efforts in which the English Department cooperated seemed to cast doubt on the effectiveness of help from this quarter applied to a technical field.

Other participants confirmed the difficulty of obtaining competent instruction that would be tailored to the particular professional and scientific needs of pharmacy students. It was also pointed out that such instruction is expensive, since it rests upon various written and oral exercises, individually supervised.

Sonnedecker called attention to an experiment at Ohio State University that helped meet the objectives without a special course. This centered about a mock A. Ph. A. convention, as he understood it, for which students prepared papers during the year in connection with other course work. The"convention" or meeting at the end of the year, in which this work culminated, gave students experience in organizing and conducting meetings, and in preparing and delivering papers. Lloyd Blauch of the U. S. Office of Education reported that similar projects had been undertaken among dental students, with worthwhile results. Blauch added that his association with professional education in the health field convinced him that there was a rather clear need for developing better facility in "professional communications," by whatever means that might be possible.

The discussion seemed to indicate a marked concern about deficiencies among students in using sources of information with discrimination, and in organizing and presenting material effectively for professional purposes. While the problems of scheduling and of teaching a separate course were considered pressing, considerable interest was expressed in giving more attention to developing the skills of professional communication somewhere in the student's educational experience.

The second session of the professional orientation workshop, with Karl L. Kaufman of Butler University presiding, was devoted to the instructional topics: (1) history of pharmacy, and (2) ethical and professional relations.

Sonnedecker of the University of Wisconsin was asked for an introductory statement, to open the discussion of instruction in the history of pharmacy, which is reproduced below:

INTRODUCTORY REMARKS TO DISCUSSION ON *HISTORY OF PHARMACY*

I take it that the main purpose of this part of our Workshop will be to determine what to teach in a course mainly devoted to the history of pharmacy, and to map that constellation of conditions that will permit us to teach it in the best possible way.

Little time need be spent defending the teaching of such a course. Its legitimacy in the curriculum seems to have been accepted, at least in principle.

Nearly all schools now teach the history of pharmacy —in one form or the other, more or less. There are of course still some who believe that the one, two, or three credits devoted to the subject must – or should – yield to increasing demands for clock-hours in scientific and commercial instruction. But I doubt if time can be invested here effectively in trying to change this minority opinion.

We can more profitably devote the time to defining more clearly the objectives, content and methods of instruction in the history of pharmacy. Let's assume that this instruction stands at the same level as other subjects in the curriculum. That may be a goal rather than actuality at a particular time or place. But we can take for granted that we are not considering memory exercises on an array of dates dangling from a thin line of narrative, nor the bare bones of collected facts devoid of understanding or interpretations, nor a lonesome pharmaceutical story, isolated from what goes on in the professional and social world around us.

If we turn away from what history, in our sense of the word, is *not*, we come to the positive values we expect to derive from it. We arrive at the first topic scheduled for discussion: the *objectives* of the courses. As a starting point I might suggest that:

WE EXPLORE THE HISTORY OF PHARMACY–

1. To meet the problems and opportunities of pharmacy from the vantage point of historical perspective and in the light of previous experience.
2. To obtain a clearer sense of pride, dignity and purpose through understanding the professional heritage hammered out by the efforts of predecessors.
3. To see and accept our social responsibilities – through which scientific knowledge becomes fruitful – by familiarity with pharmacy's role in society.
4. To understand the influence of professional, scientific and social developments in various societies and historical periods that led to pharmacy as we know it today.
5. To enhance our interest in, and enjoyment of, the profession by becoming acquainted with pharmacy in other lands, and with the historical and cultural aspects of our concepts, symbols, equipment, processes, drugs, and services.

There appeared to be agreement with the stated objectives, although some feeling that they could not be achieved fully in the number of clock hours usually available. Sonnedecker indicated that all objectives of instruction in the history of pharmacy would not necessarily be met by a survey course. It seemed more important for each teacher to focus his course upon aspects that his knowledge and interests could make most meaningful. Other objectives might remain goals for further development of the survey course or for more specialized elective courses. He felt that there was some risk of trying to cover so much material that interpretation and understandings would be sacrificed.

Sonnedecker suggested that the history of pharmacy course could be broadest and most meaningful when offered late in the curriculum as a final orientation of the student to his profession. He went so far as to suggest that probably it was not worth while to try to teach pharmaceutical history as part of the freshman orientation course, except for purposes of comparative illustration and incidental background. This view was questioned by several teachers experienced in using pharmaceutical history as a major tool in teaching freshman orientation.

G. R. Paterson of the Faculty of Pharmacy at the University of Ontario was called upon to describe his course in pharmaceutical history and literature. Especial interest was expressed in his broad treatment of primitive medicine and the early period in the development of health services. Paterson pointed out his departure from usual practice by covering European pharmaceutical history mainly through reading assignments, thereby opening more time for background material in general history and the history of pharmacy in Great Britain, which had the strongest influence on pharmacy in Canada. Paterson then distributed a course outline, which is reproduced below–

PHARMACEUTICAL HISTORY AND LITERATURE

E. R. Paterson

2 lectures weekly, spring term

Lecture 1–Introduction to the History of the History of Pharmacy.
Development of History of Sciences as academic disciplines.
Text and References in History of Pharmacy.
References in History, History of Medicine, History of Chemistry, History of Biology, etc.
Details of Essay, replacing mid-term examination.

Lectures 2-7 *incl.* (6 lectures)
Pre-Historic and Primitive Medicine.
Pre-History and its divisions.
Dating–Relative (Stratigraphy, typology, Geology, Palaeontology, Palaeobotany, Climatic evidence).
Absolute (Time needed for culture changes, time necessary for geological work, decay of radioactive materials, geochronology, dendrochronology, historical evidence).
Historical Approach to Medicine.
Historical Methods for Medicine.
Sources, direct and indirect.
Disease in Time and Space–Palaeopathology.
Materials.
Results of such studies.
Primitive Medicine:
Palaeolithic.
Neolithic.
Speculation about beginnings of medicine.
General Primitive Theories of Causation and Nature of Disease.
Preventive Measures in Primitive Society.
Medicine Men.
Diagnosis and Prognosis.
Treatment.
Rational Elements of Primitive Medical Treatment:
Physical.
Dietetic.
Pharmacological.
Surgical.

Lectures 8, 9, *and half of* 10 (2½ lectures)
Mesopotamian Medicine
Introduction.
Sources.
Sumerian Science and Education.
Sumerian Writing.
Sumerian Contributions to Civilization.
Code of Hammurabi.
Astrologic Concepts and Sumerian Medicine.
Assyro-Babylonian Medicine.
Drugs.
Pharmacy in Assyria.

Lectures 10 *(half)*, 11, 12, *and* 13. (3½ lectures)
Egyptian Medicine
Introduction.
Sources.
Egyptian Medicine and Decipherment.
Chronology.
Medical Papyri.
Origins of Egyptian Medicine.
Medicine and Surgery in Ancient Texts.
Drugs and Prescriptions in Ebers Papyrus.
Edwin Smith Papyrus.
Professional Practice.

Lectures 14 *and half of* 15. (1½ lectures)
Medicine of Israel, China and India.
Israel
Introduction.
Literature.
Chronology.
Fundamental Concepts of Jewish Medicine.
Sanitary Legislation.
Medical Practice and Therapeutics.
China
Introduction.
Origins & Characteristics of Chinese Medicine.
India
Introduction.
Sources.
Medical Concepts.
Surgery and Rhinoplasty.

Lectures 15 *(half), and* 16-20 *incl.* (5½ lectures)
Greek Civilization, Greek Science, Greek Medicine.
Introduction—Aegean Civilization.
Invasions of Greece.
Earliest European Literature. (Homer)
Introduction to Hellenic Medicine.
Crete.
Characteristic Features Dominating Greek Civilization.
Homeric Medicine.
Mythical and Priestly Medicine (Cult of Aesculapius).
Dawn of Scientific Medicine—Early Philosophic Schools.
Greek Colonies in Asia
Schools of Miletus, Ephesos, Cos (Hippocratic)
Greek Colonies in Italy and Sicily
Pythagoreans. Empedocies.
Mainland of Greece.
Anaxagoras, Democritos.
Athens—Socrates, Plato, Aristotle.
Alexandrian Age.
Graeco-Roman Period.
Hippocrates of Cos.
Hippocratic Corpus.
Hippocratic Drugs.
Oath of Hippocrates.
Hippocratic Physiology.
Socrates, Plato, Aristotle, Theophrastos.
Epicurus (Epicureanism) and Lucretius.
Alexandrian Anatomists. Hostility between schools.
Hellenistic Medicine and Botany after Decline of Alexandria and during Glory of Rome.
Mithridates, Asclepiades, Themison, Heraclides.
The Rhizotomoi.
Roman Organization of Medical Studies.
Celsus, Scribonius Largus, Pliny, Dioscorides, etc.
Decline of Science in Late Antiquity.
Galen.
Galen's Writings.
Galen's Anatomical Investigations.
Theory of Four Humours.
Galen's Drugs.
Post-Galenic Literature.

Lecture 21. (1 lecture)
Origins of Alchemy.
Introduction.
Beginnings of Chemistry.
Pseudo-Democritos, Maria the Jewess, Zosimos.
Early Chemical Papyri.
Alexandrian Chemistry.

Lectures 22 *and half of* 23. (1½ lectures).
The Muslim World.
Pre-Islam.
Islam.
Expansion of Islam beyond Arabia.
Nestorianism.
Arabic Science.
Jabir and Geber.
Mesue Senior and Mesue Junior.
Rhazes.
Avicenna.
Ibn-al-Baitar.
Arabian Pharmacy.
Mohammedan Spain in the 12th century.
Maimonides. Oath of Maimonides.
Paths by which Graeco-Arabic Knowledge Reached Western Europe.

Lectures 23 *(half)*, 24, *and* 25. (2½ lectures).
Medicine in the Christian West During the Middle Ages.
Graeco-Roman Traditions.
Cassiodorus, St. Benedict, Benedictine Monasteries.
School of Salerno.
Evolution of Mediaeval Medicine.
Frederick II of Hohenstaufen.
Birth of European Professional Pharmacy.
Medicine in the Later Middle Ages.
The Universities.
Famous Figures of Late Middle Ages.
Albertus Magnus.

Roger Bacon.
Arnaldus de Villanova.
Saladino de Ascoli.
Practice of Medicine, Surgery, and Pharmacy in Late Middle Ages.

Lecture 26. (1 lecture).
The Development of Pharmacopeias.
Terms Used for Legally Enforced Pharmaceutical Standards.
Sources of "Pharmacopoeias".
Precursors of "Pharmacopoeias".
Conditions Necessary for Establishment of Pharmacopoeias.
Reasons for Issuance of Official Standards for Pharmacy.
Nuovo Receptario.
Dispensatorium . . . authore Valerio Cordo.
Purification of Pharmacopoeias.
First Editions of National Pharmacopoeias.

Assigned Reading.
Chapter 4—The Development in Italy.
Chapter 5—The Development in France.
Chapter 7—The Development in Germany.

Lectures 27 *and* 28. (2 lectures).
Development of Pharmacy in Britain.
Introduction.
Society of Apothecaries.
Battle of the Dispensaries.
Chemists and Druggists.
History of The British Pharmacopoeia.
Other Pharmaceutical Literature.

Lectures 29, 30 *and* 31. (3 lectures).
Pharmacy in Canada.
Primitive Indian Medicine.
Scurvy Among First French Settler (1535-1608)
Early French Physicians and Apothecaries.
Louis Hebert
Jean Madry
Michael Sarrazin
Shadows on the Rock—by Willa Cather
First Medical Legislation.
Pharmacy and Medicine in Upper Canada.
Pharmacy and Medicine in Lower Canada.
Pioneer Retail Pharmacies.
Canadian Schools of Pharmacy, Provincial Associations and Pharmacy Acts.
Ontario College of Pharmacy.
Manufacturing and Wholesale Pharmacy.
Canadian Pharmaceutical Association.
P.A.T.A.
Canadian Formulary
C.C.P.S.
C.C.P.F.
C.F.A.P.
C.Ph.A. Code of Ethics.

Sonnedecker mentioned that Paterson had taken a minor in the history of pharmacy at Wisconsin, with his doctoral program in pharmaceutical chemistry. Other men with minors in this field would gradually become available to help solve the problem of teaching personnel for schools that have no qualified teacher and cannot add a man with a Ph. D. major in historical and social aspects of pharmacy and allied fields.

George Osborne commented upon an elective course he offers at the University of Utah, which places emphasis upon student research in local and regional history. Proficient students are permitted to continue work for special credit subsequent to the formal course.

Sonnedecker then commented upon and distributed the following material: (1) a list of some guides to information and bibliographic aids for teachers, (2) two lists of historical illustrations available to teachers, (3) an assignment sheet representing one approach to book reports, and (4) typical examinations used for courses in the history of pharmacy and in freshman orientation. A list of Bibliographic aids to work in the history of pharmacy and lists of historical illustrations available from the Smithsonian Institution and the University of Wisconsin were distributed. Copies may be obtained upon request to the School of Pharmacy, University of Wisconsin, Madison 6, Wisconsin.

BOOK REPORT IN HISTORY OF PHARMACY

Your report should consist primarily of thoughtful answers to the following five questions:

1. Define briefly the *scope* of the book. Outline concisely how the author *organized* his material. Suggest one way that the author could have handled his subject differently or better.
2. What objectives. and what reader audience do you think the author had in mind when writing the book? How well did he succeed in achieving his purpose?
3. In what way was the book most useful or interesting to you?
4. Summarize what two reviewers said about the book. Do you agree with their praise or criticism? (To locate reviews see the "Book Review Digest". annual indices of the *Bulletin of the History of Medicine,* and *Journal of the History of Medicine and Allied Sciences,* or other aids that may be suggested by the librarian.)
5. What is the professional background of the author (i.e., education and experience)? Do you think he was suitably qualified to write this particular book? (For biographical data, consult a national or regional "Who's Who," or more specialized biographical reference works.)

Discussion brought out the thought that if general education or social studies were to have a place in the pharmaceutical curriculum the history of the pharmacist's own profession and its relation to other social and scientific developments would have a logical place. It was suggested that the importance of the course in the curriculum largely hinged upon the teacher and the way the subject was taught.

Sonnedecker pointed out that possibilities existed at the University of Wisconsin for special study by those already teaching and who are not necessarily interested in an advanced degree in the history of pharmacy. George Osborne of the University of Utah, for example, will be at the University of Wisconsin for the year 1954-55 as a faculty fellow of the Ford Foundation in the history of pharmacy and related fields.

Visual aids, discussion groups, and term papers were among other topics commented upon. There seemed to be general agreement upon giving the student an international understanding of the development of

pharmacy past and present; upon topical development culminating in contemporary analysis; and upon providing as broad a historical and social background for the pharmaceutical story as instructional time permits. Three semester-hours seem to be required for any serious approach to the subject at this level, although experiences represented in the workshop varied widely with regard to position of history of pharmacy in the curriculum, level of instruction, clock hours available. and combination with related subjects such as literature or ethics.

ETHICAL AND PROFESSIONAL RELATIONS

The final subject examined in the professional orientation workshop was the inculcation of professional ethics. Karl L. Kaufman was asked to open the discussion with a short report upon his teaching experience in this field at Butler University.

Although Blauch and Webster combine ethics and professional relations (*The Pharmaceutical Curriculum,* pp. 163-164) the speaker remarked that his presentation, like his teaching experience, touches professional relations only to the extent that ethical issues are involved. He observed parenthetically, however, that the observance of good ethics undoubtedly promoted good professional relations in its broader sense.

It was pointed out that at Butler University, History and Ethics are combined in one course, contrary to recommendations in the Blauch and Webster book, "Pharmaceutical Curriculum." It was further stated that this was done partially through necessity, but that this combination had been found to be reasonably successful. It also was felt that the objectives given under the "Ethics and Professional Relations" course by Blauch and Webster were achieved.

At Butler University the course began with ancient history and switched to ethics after consideration of the ancient Greek civilization. This required a chronological reversal in order to mention the earlier codes and other items of ethical nature which appeared before the time of the Greeks. The group at the conference was reminded that at this particular school the student had had some introduction to the meaning of ethics in the earlier course, "Orientation in Pharmacy." (Given to pre-pharmacy students; the "History and Ethics" course is given in the Sophomore year at present).

Inasmuch as the reprints and outline Kaufman distributed listed the subject matter generally followed, the speaker used his brief time to comment upon certain points, which were based upon his ten or more years' experience in teaching Ethics. The principal points mentioned were:

1. That the most important objective of the unit on Ethics was to create an attitude of mind, or in some cases, to foster and develop an understanding of the ethical responsibilities of a professional person.

2. The combination of History and Ethics into one course seems to make the subject of history more "palatable" to the student if properly done. It was noted that it might be more satisfactory if it were possible to schedule the history in a later year of the curriculum. The speaker had not had personal experience by which to make a comparison.

3. "Sloganeering" is a useful class room device for the teacher. However, the phrases and slogans must have a freshness and must not be allowed to become mere clichés.

4. Preaching or the semblance of it must be avoided.

5. Discussion initiated by the class members appears to be the most valuable way to clarify and illustrate the problems of Ethics. It was mentioned that two full periods are devoted especially to this type of discussion, even though students may raise questions during any of the other class meetings. Techniques for encouraging student initiative in discussions were mentioned. Newspaper and magazine clippings with ethical connotations were listed among the suitable "spring boards" for discussions.

6. It was noted that many sophomores tend to confuse Ethics and Jurisprudence, and that it was desirable that the instructor be especially careful to avoid careless statements which might add to this confusion.

7. Students desire a "pat" answer to problems of an ethical nature. They see things as black and white, usually not realizing that they have only a part of the facts at hand. This means that a good deal of patience on the part of the instructor is required, if the students are to learn to formulate correct conclusions.

8. It was emphasized that the teaching of ethics is a four-year job; that it cannot be covered once and forgotten. Teachers in the other professional courses at Butler University College of Pharmacy are required to make references to ethical problems in their various courses.

9. The problem of assessing results obtained from such a unit of work was mentioned briefly. Two points seem to indicate its value: (a) Students show that they have found it interesting and consider it of some importance, both during and after the course. This is indicated by remarks and questions volunteered long after they have been exposed to the work. (b) A number of comments have been made by retail pharmacists who have noted some change in the attitude of their part-time student employees. Sometimes the retailer's comment has not reflected great satisfaction. This undoubtedly means that the student's standards are higher than those of his employer.

During his presentation Kaufman distributed reprints of his articles upon teaching ethics that appeared in the *American Journal of Pharmaceutical Education,* 17 (1953), 225-229 and 18 (1954), 255-260, as well as the outline for his course on History and Ethics that is reproduced below. He indicated that it was not his intention to review the Butler method as shown in the reprints and outlines (see also his outline reproduced under "Pharmacy Orientation for Beginning Students"); these materials were offered as bases for discussion, he said, rather than as a "model" system.

HISTORY AND ETHICS

Pharmacy 258
Three Credit Hours
K. L. Kaufman
Butler University

Objectives:

1. To instill a sense of professional pride.
2. To acquaint the student with the ethical obliga-

tions of a professional person.
3. To furnish a general knowledge of the origin and development of the profession.
4. To suggest the possibility of forecasting the future on the basis of past experiences.

Text:

Kremers and Urdang "History of Pharmacy" is strongly recommended.

References:

All resources of the library may be employed, as the assignments are not specific enough to be limited to a particular list of books.

First Week
1. General Introduction and Survey
2. The antiquity and ancestry of man
3. Primitive science; animism and deities

Second Week
4. Survey of ancient civilizations and their mythologies.
5. Mythologies, magic, and medicine; some ancient scientists
6. The origins of professional oaths and codes of ethics

Third Week
7. Oaths and Codes of Ethics
8. Oaths and Codes of Ethics
9. Oaths and Codes of Ethics

Fourth Week
10. Quiz (First library report due)
11. Discussion of Codes and Practices
12. Discussion of Codes and Practices

Fifth Week
13. Discussion of Codes and Practices
14. Discussion of Codes and Practices
15. Discussion of Codes and Practices

Sixth Week
16. Discussion of Codes and Practices
17. Discussion of Codes and Practices
18. Discussion of Codes and Practices

Seventh Week
19. A. Ph. A. Code and Applications
20. A. Ph. A. Code and Applications
21. Discussion initiated by class

Eighth Week
22. Discussion initiated by class
23. Liberation from Selfishness
24. Thirteenth century foreshadows Renaissance

Ninth Week
25. Paracelsus and Other Figures and Data
26. Medical Theories and their effects on Pharmacy
27. Test

Tenth Week
28. Pharmacy in Italy
29. Pharmacy in France
30. Pharmacy in France; Role of Religious Workers; Spain (Slides)

Eleventh Week
31. Pharmacy in Germany
32. Review (Second library report due)

Twelfth Week
34. Pharmacy in England and Scotland
33. Test
35. Pharmacy in England and Scotland
36. Pharmacy in England and Scotland (Slides)

Thirteenth Week
37. International Trends
38. International Trends; Laws
39. International Trends; Socialization

Fourteenth Week
40. The North American Colonies
41. The Revolutionary War
42. Post-Revolutionary Pharmacy in the U. S.

Fifteenth Week
43. Slides and Review
44. Rise of Legislation
45. Education in Pharmacy

Sixteenth Week
46. Development of Literature
47. Pharmacopoeias and Formularies
48. Contributions by Pharmacists

Seventeenth Week
49-52 Examinations

Ralph W. Clark of the University of Oklahoma has been likewise active in experimenting with ways to enhance the professional and ethical attitudes of graduates. He was therefore invited to give a semi-formal presentation concerning his course in orientation and ethics, which could be presented only in summary because of the late hour but is reproduced below.

ORIENTATION AND ETHICS FOR PHARMACY STUDENTS

RALPH W. CLARK
University of Oklahoma

I have come to the conclusion, as many of you have also, that the place to begin to improve pharmacy is with the group of young men and women who are enrolled in our colleges of pharmacy. They will be actively engaged in the practice of the profession in the very near future, and we must look to them to rebuild and maintain the integrity of our profession which is questioned at times because of the unethical behavior of a few of its members. This plan means that what is taught to freshmen in my course is followed up throughout their college career by other instructors.

It was my privilege to have had twelve years of close association with Edward Kremers, both as a student and as a colleague. He was an outstanding scholar who never compromised on a principle. Thanks to my experience with Dr. Edward Kremers, I find it possible to resist demands for an ever-changing, poorly balanced curriculum and a more or less local code of ethics to meet the desires of practicing pharmacists to fit their own needs or to solve what to them as individuals may be serious problems. It is probable that pharmacy faculties are the best judges of educational activities required for the pharmacists of the future. Certain local requirements, skills or lack of skills, must influence their program. My faculty members have given me the benefit of constructive criticism of the course in orientation at the University of Oklahoma College of Pharmacy.

It was Dr. Kremers, too, who more than fifteen years ago, was impressed by a quotation from a former dean

of a college of engineering who said. "We do not pretend to educate or train engineers, but men with a capacity to become good engineers". This statement may be paraphrased to express in a general way the manner in which I view pharmaceutical education. We do not pretend to educate or train pharmacists, but men and women with a capacity to become good pharmacists, in the branch of pharmacy of their choice, who uphold the professional ethics and integrity of their profession. It leaves an important place for the apprenticeship system.

Our faculty members are requested to submit and follow a syllabus for each course. Perhaps you may wish to discuss this procedure. My feeling is that it is the only way to correlate content of courses and to integrate an educational program. Each syllabus is introduced by a statement of the objective of the course. The objective of the course in Orientation as I teach it follows:

> "To introduce the student to pharmacy by presenting parts of the profession which, when put together in detail in later courses, make up the total academic education for a health profession. The curriculum, the use of the library, historical development, pharmaceutical literature, organizations, business and professional ethics and the opportunities, problems and limitations in pharmacy are presented. Lectures are given for one period each week; a class discussion of the lecture and supplementary assignments in the text and elsewhere also takes place one period per week."

The course in orientation begins with the history of pharmacy. The reason for this procedure is very well stated in the preface to *History of Pharmacy* by Kremers and Urdang. "The history of pharmacy is replete with inspiration for the youthful disciple who is preparing to devote his life to the service of mankind. This alone ought to make its study worth while. Important as this aspect may be, it is perhaps equally important that the pharmaceutical practitioner knows the past in order that he may understand the present and plan intelligently for the future."

This is to be an open discussion. I wish to offer two controversial opinions which should promote discussion. First, I favor a course combining history, ethics, and a survey of pharmacy. It appears to me that a lack of understanding of pharmacy has contributed to the unethical practices which have brought about severe restrictive legislation. I do not consider a separate course in the history of pharmacy for freshmen desirable. Second, my emphasis has been on United States history of pharmacy. Based on my experience it is my observation that this presents more interesting and more pertinent information in a course in orientation for freshmen. Student interest rises materially after the first few weeks in the course have been completed.

Since I have not had the advantage of formal training in philosophy or ethics, it seemed desirable that I should call on one who has a fine background to discuss ethics in our freshmen course in orientation. Such a man was Dr. J. Clayton Feaver, professor of the philosophy of ethics and religion. Perhaps many of you have a similar situation in your college so that you may call on a professor in another department to address your class. I recommend this procedure. Dr. Feaver cooperates fully in every way and makes a real contribution to the course. Incidentally, some of our students have become interested to the extent that they enroll in a course in Ethics taught by Dr. Feaver, as an elective.

Our guest, Dr. Feaver, spoke on "Religion and Ethics in the Professions". He said, "The basis upon which we approach the matter of professional ethics is the assumption that man feels within himself both a moral awareness and a moral obligation. It is this deep rooted feeling that makes the matter of any professional expression of ethics significant. Except the individual realizes that a sound sense of ethical evaluation penetrates the whole of his thought and action. he is impotent actually to make an adequate moral response in the area of his particular professional life. In other words, ethics, as likewise religion, is a fundamental part of the human existence and must be carefully considered."

This introductory statement, according to Dr. Feaver, sets the background for the ethics of a profession. In a real sense professional ethics is nothing else than a specific application of man's total moral awareness and discipline. As a specialist, moreover, it becomes doubly urgent upon him to see that his total ethical code is applied. He poses before his fellow men as a responsible specialist and therefore he is trusted by them as being such. The obligation under which this places him is tremendous. He can in no sense keep faith with his fellows unless to the very best of his ability he meets this obligation to the full.

Dr. Feaver's lecture is followed by lectures and discussion of professional and business ethics.

The A. Ph. A. Code of Ethics is discussed in detail.

The discussion of religion and ethics has been scheduled to coincide with our religious emphasis week. This plan has not been successful because only one of several of the visiting gentlemen of the cloth understood the assignment and stuck to his subject!

I thoroughly enjoy teaching the freshman course in Orientation and it appears to me that freshmen enjoy it too! They are eager to find out more about pharmacy. They are glad to have an opportunity to apply their religion, from their home training, in the form of professional and business ethics. They want to hear from others that the public respects pharmacists with the few exceptions of those who play "fast and loose" by selling legend drugs without prescriptions or disregard public health in other ways. We urge our students not to betray the trust put in them in a world in which there are many mistrusts and suspicions. We discuss the five virtues of the ancient philosophers (Wisdom, Courage, Self-Control, Truthfulness and Justice); the difference between a trade and a profession; *caveat emptor versus caveat vendor;* definitions of pharmacy and a drug; advertising; intent; negligence; lying; and carelessness. The student is taught that in business, knowledge is to be desired, but that in a profession it is an obligation. It is more than a coincidence that when senior students com pound prescriptions they use actual trade name products—no substitution is permitted. This means that

Argyrol is Argyrol and Adrenalin Chloride Solution is Adrenalin Chloride Solution. Other correct procedures are followed during the important training period when habits are developed, and prescriptions are compounded in clean containers with accuracy, neatness and dispatch. In pharmacology, seniors are taught to respect drugs and laws governing their distribution.

We have evidence that our graduates profess and practice "It is Right to do Right"; that they conform to accepted rules of professional conduct.

Sonnedecker suggested that it was too glib to dismiss professional ethics as something that had to be caught rather than taught; and he felt that results worth wider adoption were emerging from schools experimenting in this field. The historical development of ethical codes in the health field, as an inherent part of professionalization, should be examined wherever formal instruction is given in the curriculum; but this should culminate in a frank analysis of current ethical problems, preferably by group discussion of case histories. A mimeographed brochure was distributed containing medical and pharmaceutical codes and oaths from various historical periods, as designed for background material in a discussion section on professional ethics. Copies are available upon request to the School of Pharmacy, University of Wisconsin, Madison 6, Wisconsin.

It seemed to be agreed that a school of pharmacy shares the responsibility for creating firm professional and ethical attitudes; that imparting stimulus, pride and understandings — rather than exhortation — offered the most promise; that while there should be a definite place for instruction and discussion, a lasting influence perhaps must be achieved by supplementary efforts to sensitize the student to ethical issues during the complete span of his college experience.

HAVE WE REALIZED OUR OBJECTIVES? SUMMARY AND REVIEW

By Lloyd E. Blauch

Chief for Education in the Health Professions
Office of Education
U. S. Department of Health, Education, and Welfare

The committee for the seminar has asked me to summarize and review our accomplishments. I do this with some reluctance, for such an undertaking must necessarily reflect subjective judgments, of which there are no doubt many, concerning our success and failure. Moreover, I was an interested participant, as well as a spectator, and I am therefore not without bias. I want merely to sound this note of warning and to suggest that my judgments and conclusions may be open to question.

General Surroundings

Let me begin with a brief comment about the general conditions and surroundings of the seminar. Few colleges of pharmacy could do so well in providing such convenient and satisfactory quarters. Here we have lived together very happily for almost a week. Everything was done for us in fine order, to the last detail. As I drove up to Storrs I wondered just how we would find the exact spot to which we should go. Sure enough, orange colored placards had been placed conspicuously on the highway and the byways to direct us. I am sure at least some of you had the same feeling I had when seeing those signs. I knew that someone was on the job and that all would be well. And then the cordial reception we received from Dean Hewitt, Arthur Schwarting, Professors Jannke, Fenney, and others of the local committee made us feel at home from the start. From that day to this moment all of us have been greatly pleased with the arrangements so well made for us.

On behalf of all of us I want to express our gratitude to Dean Hewitt and all those who have worked with him during the past few months to make this endeavor a success. Hal, we are indeed grateful to you for doing a big job so well. I trust that you will also convey to the President of this fine university our thanks for the contribution he and the institution have made to the seminar.

Principles of Learning

Let us now turn to the work of the seminar. I am asked to indicate whether we have realized our objectives. As I have studied what we have accomplished and have talked with some of you about this matter, I have come to the conclusion that the answer is emphatically "Yes!". I have heard no dissenting vote. To be sure, all of us have seen spots where slight improvement might perhaps have been made, but the seminar in its entirety has been eminently successful. Everything has gone so well, first, because the program was well organized and carried on, and, second, because all of you participated in it and carried your share of the load.

You will remember that in my paper on Sunday evening I suggested six objectives of the seminar. The *first* of these was for us to gain greater comprehension of the principles of learning with particular reference to the education of students of pharmacy. This was perhaps the most difficult of our objectives. We realized it in part but hardly to the extent that was desired, partly because a sufficient amount of time was not devoted to it.

Several points in particular stand out. Our attention was directed to the great importance of motivation in learning. The explanation of memorizing was most opportune, for it touched on one of the great shortcomings in pharmaceutical education. I have been greatly impressed by the tremendous amount of rote memorizing that students of pharmacy do. One of your principal teaching problems is so to organize and teach the content of pharmacy and its related sciences that it will be learned through comprehending its meaning — its logical relationships — rather than through mere memorizing. The student must learn a large number of technical terms, drugs, dosages, and a plethora of other facts. One of your functions as teachers is to tie this information together in such ways that it can be readily understood and learned, and applied to the various services which pharmacy renders. Much more than rote memorizing is required We also listened to good discussions of perceptual and motor learning.

The one aspect of learning that received only passing attention, largely I suspect because of lack of time, was problem solving and arriving at generalizations. One seminarian expressed to me the great need for emphasizing this form of learning in pharmacy, and he suggested that at a future seminar some time should be set aside to give special attention to it. His point is well taken. No doubt you will want to study this particular form of learning, for the solving of problems and the development of generalizations represents the culmination of learning achievement.

We heard a most entertaining discussion of language in relation to learning and teaching. Although the speaker refused to present a manuscript, I hope that the edited transcript of his address will be a useful contribution which we shall want to study rather carefully. For a long time I have felt that we have not given enough attention to the role of language in learning and thinking. The address did not answer all the questions on this subject, but I hope it whetted our appetite for further explanation of a subject which is so basic to almost everything a teacher does.

How to Teach

The *second* of our objectives was to increase our knowledge about how to teach. You have probably noted that college teachers when discussing their work almost invariably talk about the subject matter they use rather than about *how* they use the subject matter to accomplish their purposes. They tend to shy away from methods of teaching, perhaps because they have less familiarity with methodology than with content. This fact was recognized by the committee which planned the program, and it determined to use every means to place the emphasis on the teaching and learning process. In this respect the seminar was highly successful.

We were told much about teaching that should prove helpful. The paper on the nature and function of educational objectives suggested the role that sound objectives play in all effective teaching. I have been much impressed by the increasing reference you are making to educational objectives. That is a sign of good educational thinking.

The addresses on methods of teaching suggested how and why the methods a teacher employs are important in his work. They suggested also that the successful teacher uses a number of methods, depending upon his personality and competence and upon his purposes and the students he teaches. There is evidence that teachers in colleges and universities, and certainly in our colleges of pharmacy, are becoming increasingly concerned about their methods and are taking pains to learn about them. I have noted your expressions of approval that this subject had a large place on the program.

In my judgment the papers on laboratory instruction and demonstrations were particularly helpful. Large sums of money are spent on these forms of teaching, and we need to be especially concerned that we shall use the laboratory efficiently as well as effectively. We need further discussions of how the best results can be had through the use of the laboratory.

The Thursday morning session on testing was one of the high spots of the seminar. There was, perhaps, too much emphasis on machine scoring at the expense of time that might have been given to the procedures each classroom teacher uses, such for example as converting scores into grades. One seminarian has suggested that at some time during the seminar he would like to have heard a discussion of the use of statistics in testing. One important phase of testing — the testing of performance — was omitted because of lack of time for it. In spite of these limitations, enough of the principles of testing and examining were covered to make us aware of good practices as well as of the problems involved in this phase of the teacher's work. We surely derived great benefit from the speaker's fine presentation.

The Friday forenoon session devoted to audio-visual aids made another very significant contribution to the seminar. Such aids are finding increasing use in teaching, and we need to learn more about them and how they should be employed. The fundamentals of these aids were well explained and splendidly demonstrated.

Desire to Do Good Teaching

The *third* objective of the seminar was to encourage and promote a desire to do the best teaching. The attainment of this objective is not easily measured, but the enthusiasm I have observed during the week and your individual expressions as to how you will improve your teaching next year leave me in no doubt whatever about the accomplishment of this objective. You came here with a desire to learn how to improve your teaching; that desire has been materially increased.

Literature on Education

The *fourth* objective was to increase the worthwhile literature on pharmaceutical education. In this we have been quite successful. I regard most of the papers as very good; some of them are excellent indeed. They represent some of the best thinking on record about the teaching of pharmacy and related subjects.

Let me interject a parenthesis here. You will remember Dr. Weston's suggestion on Tuesday evening that a communication to an audience should not be read; it should be spoken as an extemporaneous address. In general I think that is good advice, especially for such a subject as he dealt with, and when a speaker speaks as well as he does. However, on many occasions, and particularly in our seminars, I much prefer to listen to the reading of a paper. When the speaker comes to the platform with a paper I know he has devoted a good deal of time to thinking through his subject and formulating his ideas. Moreover, I expect he will conclude on time, although at times I am disappointed. And finally, he has made a record which I can study at my leisure and preserve for future reference. Such advantages cannot usually be had from an extemporaneous address. Anyway, the seminar committee desired to receive papers from the speakers on the morning programs, and we shall soon be presented with a volume which I, for one, shall treasure.

General Education

Concerning the *fifth* objective of this gathering — the improvement of our general education — I need not say much. With respect to it our experience is individual and highly variable, for each comes and goes his own way. A goodly number of us have been exploring what for each has been new scenery, learned some of the lore of New England, and observed the ways by which people live in this interesting region of our country. This part of our experience has been highly profitable.

Personal Acquaintance

The *sixth* objective — that of becoming personally and professionally acquainted with one another — has most surely been realized. Our living arrangements, the fine quarters for the meetings in the Student Union, the group discussion sessions, and the hour for "the pause that refreshes" (coca cola served free), all combined to help us to learn about one another.

We are some 300 including the wives and children. Apparently there were enrolled about 200 teachers, deans, and graduate students. Never before, to my knowledge, have so many pharmaceutical educators been gathered under one roof for the specific purpose of talking over their teaching problems. And never have I seen a group of educators in any field whose

evident enthusiasm for what they were doing reached the height I have noted here.

Additional Comments

In concluding this review let me make several additional comments. *First,* I want to refer to Dr. Weston's splendid address on "Methods of Presenting Technical Papers" on Tuesday evening. We shall not soon forget it. By his clear and interesting exposition as well as the pertinent and useful content of the address he convinced us of the need for college teachers to develop skill in public speaking, particularly in speaking on educational and technical subjects. This aspect of the college teacher's work is often neglected by him.

Second, Deno's paper, with its reference to the traits of good and poor teachers, to the findings of the teaching survey at Brooklyn College, and to the methods used for evaluating college teachers and their service, was a most appropriate conclusion for the seminar. It made us well aware of the fact that teachers are evaluated, whether or not they recognize it, and that by some definite effort at self evaluation they can often be made aware of their shortcomings and the improvement they need to make.

Third, in my judgment the afternoon discussion sessions constituted a most successful feature of the seminar. I made the round of these sessions several times to gain some idea of what they were doing and accomplishing. In all of them there was great interest and extensive participation in the discussions. It was heartening to note the very active interest of the younger teachers.

I felt that in the discussion sessions the members of the seminar came to grips with their own individual teaching problems. Here there seemed to be no hesitation for a teacher to ask another, or a group, how he or they accomplished some particular objective. In relating these discussions to particular subjects of instruction the principles presented and explained in the morning sessions took on new meaning and interest. Although the afternoon sessions were to be devoted principally to discussion exercises, several participants violated this intention by presenting lengthy papers, but in the great majority of the sessions that did not occur. These sessions were successful beyond expectation. I feared that interest in them would flag after the first two afternoons, but apparently that did not occur.

I may say that perhaps the pharmacy section was too large. It might have been divided into two or perhaps three groups, each dealing with one subject such as general pharmacy, physical pharmacy, or dispensing pharmacy. Smaller groups would have provided more opportunity for individuals to participate in the discussion, and some of the discussions might have been more pointed. This is not said in criticism of the pharmacy section, for, as I observed it, the work of this group was well done.

Fourth, a word concerning the evening meetings on the subject of "Professional Orientation" may be in order. Although they were an extra curricular activity, they seemed to be necessary because the subject had been omitted from previous departmental seminars. In my judgment these meetings helped us to understand more fully the need for instruction in professional orientation and what can be accomplished by teaching the various subjects grouped under this heading. We were told about several promising efforts that are showing the way in this field. The concern for this instruction was demonstrated by the sizeable attendance at both evening meetings.

Fifth, a number of graduate students were in attendance at the seminar but perhaps not as many as should have been here. I believe that, as future seminars are held, we should strongly urge graduate students to attend them. One of your number, now a teacher, has said to me that as a graduate student he attended the seminar on pharmacy at Madison, Wisconsin, in 1949, where he received invaluable information and inspiration which have sustained his enthusiasm in teaching ever since that time. Surely these seminars can mean a great deal to graduate students who are preparing themselves for careers in teaching.

Finally, I want to say that during the week we have been well taught by masters and by one another. It is somewhat unusual for a group of professional faculties to devote so much time to learning how to teach. I am sure, however, that we know we still have much to learn about how best to do our work. The seminar dealt with many subjects, mostly by way of introducing them rather than by way of exhausting them. It has pointed out directions for further study, which no doubt many will want to pursue.

Another year of work lies ahead of us. We shall carry into it the new perspectives, insights, and enthusiasm we have acquired here. We shall go about our duties feeling anew that teaching is truly a great work, that we can be happy and proud to be teachers—teachers of pharmacy, teachers of young people — who are helping to build a better and finer America.

REGISTRANTS AND PARTICIPANTS
SIXTH ANNUAL TEACHERS' SEMINAR

Andrako, John, University of North Carolina, Chapel Hill, North Carolina
Anselmo, Vincent, Fordham University, New York City
Apple, William S., University of Wisconsin, Madison, Wisconsin

Bachman, R. O., University of Arkansas, Little Rock, Arkansas
Bailey, Mr. and Mrs. H. E., Wayne University, Detroit, Michigan
Bang, Haakon, State College of Washington, Pullman, Washington
Barker, Donald Y., Purdue University, Lafayette, Indiana
Barr, Martin, Philadelphia College of Pharmacy and Science, Philadelphia, Pa.
Bartilucci, Andrew, St. John's University, Brooklyn, N. Y.
Barton, Miss Beverly A., Rhode Island College of Pharmacy, Providence, R. I.
Baum, Werner C., Albany College of Pharmacy, Albany, N. Y.
Bauman, Mr. and Mrs. H. P., University of Iowa, Iowa City, Iowa
Baxter, Mr. and Mrs. Ross M., University of Toronto, Toronto, Canada
Belardo, Mrs. Luz O., Philippine Women's University, Manila, P. I.
Belcastro, Patrick F., Purdue University, Lafayette, Indiana
Bender, Maurice, Rutgers University, Newark, N. J.
Benton, Mr. and Mrs. Byrl E., Drake University, Des Moines, Iowa
Beal, Harold, University of Connecticut, Storrs, Conn.
Beltz, LeRoy, University of Connecticut, Storrs, Conn.
Berman, Lawrence, University of Washington, Seattle, Washington
Bianculli, Mr. and Mrs. J. A., University of Pittsburgh, Pittsburgh, Pa.
Biles, Mr. and Mrs. J. A., University of Southern California, Los Angeles, Cal.
Billett, R., Boston University, Boston, Mass.
Bingenheimer, Mr. and Mrs. L. E. Jr., University of Tennessee, Memphis, Tennessee
Blauch, Mr. and Mrs. Lloyd E.. U. S. Office of Education, Washington, D. C.
Blick, D., University of Connecticut, Storrs, Conn.
Bliven, Charles W., George Washington University, Washington, D. C.
Blockstein, William L., University of Pittsburgh, Pittsburgh, Pa.
Bonow, Miss Eunice R., University of Wisconsin Extension, Milwaukee, Wisconsin
Brecht, Mr. and Mrs. E. A., University of North Carolina, Chapel Hill, N. C.
Brewer, Willis, University of Arizona, Tucson, Arizona
Brillhart, Russell E., Rhode Island College of Pharmacy, Providence, R. I.
Brodie, Mr. and Mrs. D. C., University of California, San Francisco, Cal.
Brown, J. H., Florida A. and M., Tallahassee, Florida
Burbage, Landon W., University of Maryland, Baltimore, Maryland
Burt, Mr. and Mrs. J. B., University of Nebraska, Lincoln, Nebraska
Busse, Mr. and Mrs. Louis, University of Wisconsin, Madison, Wisconsin
Byrum, Woodrow R., Howard College, Birmingham, Alabama

Campbell, Mr. and Mrs. James A., University of South Carolina, Columbia, S. C.
Carew, David, University of Connecticut, Storrs, Conn.
Clark, Ralph W., University of Oklahoma, Norman, Oklahoma
Claus, Mr. and Mrs. Edward P., University of Pittsburgh, Pittsburgh, Pa.
Clifford, Mrs. Margaret H., University of Nebraska, Lincoln, Nebraska
Coar, Mr. and Mrs. Herbert G., New England College of Pharmacy, Boston, Mass.
Conroy, Mr. and Mrs. P. J., Fordham University, New York City
Cooke, J. Esmonde, Maritime College of Pharmacy, Halifax, Nova Scotia, Canada
Cooper, Chauncey I., Howard University, Washington, D. C.
Cwalina, Mr. and Mrs. Gustav, Purdue University, Lafayette, Indiana

Daniels, Troy C., University of California, San Francisco, California
Darlington, Roy C., Howard University, Washington, D. C.
Datta, S. C., Philadelphia College of Pharm. and Sciences, Philadelphia, Pa.
Davis, James E., University of Illinois, Chicago, Illinois
Deno, Richard A., University of Michigan, Ann Arbor, Michigan
Dodge, Mr. and Mrs. A. A., University of Mississippi, Oxford, Mississippi
Doerge, Mr. and Mrs. R. F., University of Texas, Austin, Texas

Drommond, Fred G., University of Colorado, Boulder, Colorado
Dunham, Norris, Ferris Institute, Big Rapids, Michigan
Dunn, Mr. and Mrs. M. S., Phila. College of Pharm. and Sciences, Philadelphia, Pa.
Dunten, Miss Beatrice L.. Purdue University, Lafayette, Indiana
Durrell, D. D., Boston University, Boston, Mass.
Dusenberry, James, University of Connecticut, Storrs, Connecticut

Ebel, R. L., University of Iowa, Iowa City, Iowa
Edwards, Mr. and Mrs. L. D., Purdue University, Lafayette, Indiana
Eisen, Henry, St. John's University, Brooklyn, N. Y.
Erickson, C. W. H., University of Connecticut, Storrs, Connecticut

Fenney, Mr. and Mrs. N. W., University of Connecticut, Storrs, Connecticut
Ferguson, N. M., University of Houston, Houston, Texas
Ferring, Mr. and Mrs. L. F., Xavier University, New Orleans, Louisiana
Feurt, Mr. and Mrs. Seldon D., University of Georgia, Athens, Georgia
Franke, N. H., Alabama Polytechnic Institute, Auburn, Alabama

Gibson, Melvin R., Washington State College, Pullman, Washington
Goodness, Joseph H., Massachusetts College of Pharmacy, Boston, Massachusetts
Goodrich, Forest J., University of Washington, Seattle, Washington
Granberg, C. Boyd, Drake University, Des Moines, Iowa
Greco, Salvatore J., George Washington University, Washington, D. C.
Green, Melvin W., American Council on Pharmaceutical Education, Chicago, Illinois
Greenblatt, Eugene, University of Connecticut, Storrs, Connecticut
Grolle, Floyd A., University of Michigan, Ann Arbor, Michigan
Grosicki, T. S., University of Arkansas, Little Rock, Arkansas
Gross, Mr. and Mrs. G. C., South Dakota State College, Brookings, South Dakota

Hall, Nathan A., University of Washington, Seattle, Washington
Halliday, J. E., University of British Columbia, Vancouver, B. C., Canada
Hammerness, Mr. and Mrs. F. C., University of North Carolina, Chapel Hill, North Carolina
Hammond, Phillip V., Howard University, Washington, D. C.
Heinz, Mr. and Mrs. Jack, Utah State Board of Pharmacy, Salt Lake City, Utah
Hewitt, Mr. and Mrs. H. G., University of Connecticut, Storrs, Connecticut
Hiner, Mr. and Mrs. L. David, University of Utah, Salt Lake City, Utah
Hoch, Mr. and Mrs. H., Medical College of South Carolina, Columbia, South Carolina
Holstius, E. A., University of Kansas City, Kansas City, Missouri
Hunter, J. E. Jr., University of South Carolina, Columbia, South Carolina

Iannarone, Michael, Rutgers University, Newark, N. J.

James, Kenneth M., University of Saskatchewan, Saskatoon, Canada
Jannke, Mr. and Mrs. P. J., University of Connecticut, Storrs, Connecticut
Johnson, Carl H., University of Florida, Gainesville, Florida
Johnson, Douglas, Southern College of Pharmacy, Atlanta, Georgia
Johnson, H. S., University of Connecticut, Storrs, Connecticut
Jordin, M. W., University of Arkansas, Little Rock, Arkansas
Jonsson, S., New England College of Pharmacy, Boston, Massachusetts
Jorgensen, President A. N., University of Connecticut, Storrs, Connecticut

Kaufman, K. L., Butler University, Indianapolis, Indiana
Kedersha, R. George, Rutgers University, Newark, N. J.
Kelz, Miss Francoise A., Columbia University, New York City
Kerr, Mr. and Mrs. W. L., University of Iowa, Iowa City, Iowa
Kidder, James H., Fordham University, New York City
Kidder, Miss M., New York City
King, Mr. and Mrs. L. D., Rutgers University, Newark, N. J.
King, Theodore, University of Wyoming, Laramie, Wyoming
Koffler, Mrs. A. H., Ohio Northern University, Ada, Ohio

LaBranche, Mr. and Mrs. E. J. Jr., Xavier University, New Orleans, Louisiana
Larwood, Charles, University of Toledo, Toledo, Ohio
Lehrman, Phillip, University of Connecticut, Storrs, Connecticut
Lemberger, A. P., University of Wisconsin, Madison, Wisconsin
Lemeshka, Mr. and Mrs. T., Rhode Island College of Pharmacy, Providence, Rhode Island
Leonard, R. M., George Washington University, Washington, D. C.
Levin, Mr. and Mrs. N., Howard University, Washington, D. C.

Liberman, Samuel S., Columbia University, New York City
Liu, Wei-Chin, Southern College of Pharmacy, Atlanta, Georgia
Lord, C. F., University of Buffalo, Buffalo, New York
Lozano, M. E., Detroit Institute of Technology, Detroit, Michigan
Luongo, Mr. and Mrs. H. J., St. John's University, Brooklyn, New York

Maier, Mr. and Mrs. A. A., University of Connecticut, Storrs, Connecticut
Maher, Frank, Mayo Clinic, Rochester, Minnesota
Matthes, J. D., Massachusetts College of Pharmacy, Boston, Massachusetts
Marcus, Arnold D., Rutgers University, Newark, New Jersey
Marano, Mr. and Mrs. R. J., Fordham University, New York City
Martin, Alfred, Temple University, Philadelphia, Pennsylvania
Matthews, Mr. and Mrs. A. W., University of British Columbia, Vancouver, B. C.
Mercer, Mr. and Mrs. Frank L., St. Louis College of Pharmacy, St. Louis, Missouri
Meriano, Mr. and Mrs. C. N., New England College of Pharmacy, Boston, Massachusetts
McCloskey, John, Loyola University, New Orleans, Louisiana
McConnell, Warren E., University of Michigan, Ann Arbor, Michigan
Mill, Ralph J., Wayne University, Detroit, Michigan
Misek, B., University of Connecticut, Storrs, Connecticut
Mitchell, J. S., Howard University, Washington, D. C.
Mittelstaedt, S. C., University of Arkansas, Little Rock, Arkansas
Miya, Tom S., Purdue University, Lafayette, Indiana
Moody, Joseph, University of Connecticut, Storrs, Connecticut
Moore, W. E., George Washington University, Washington, D. C.
Muldoon, Hugh C., Duquesne University, Pittsburgh, Pennsylvania
Mulvey, R. K., Wayne University, Detroit, Michigan
Murray, D. H., University of Buffalo, Buffalo, New York

Neptune, Mr. and Mrs. J. A., University of Wisconsin, Madison, Wisconsin
Nobles, W. Lewis, University of Mississippi, Oxford, Mississippi

O'Brien, James, University of Connecticut, Storrs, Connecticut
O'David, Mr. and Mrs. D., University of Wyoming, Laramie, Wyoming
Orr, Mr. and Mrs. J. E., Montana State University, Missoula, Montana
Olsen, Paul, Phila. College of Pharmacy and Sciences, Philadelphia, Pennsylvania
Osborne, George E., University of Utah, Salt Lake City, Utah

Parks, Lloyd M., University of Wisconsin, Madison, Wisconsin
Patel, B. N., St. John's University, Brooklyn, New York
Paterson, Mr. and Mrs. G. R., University of Toronto, Toronto, Canada
Paul, Ara, University of Connecticut, Storrs, Connecticut
Pearl, Mr. and Mrs. W., Brooklyn College of Pharmacy, Brooklyn, New York
Pella, Milton O., University of Wisconsin, Madison, Wisconsin
Platz, Miss Phyllis, University of Nebraska, Lincoln, Nebraska
Plourde, R., University of Montreal, Montreal, Canada
Pokorney, Frank J., Columbia University, New York City
Putney, Blake F., Rutgers University, Newark New Jersey

Rabe, Charles C., A. Ph. A. Headquarters, Washington, D. C.
Ramstad, Egil, Purdue University, Lafayette, Indiana
Raubenheimer, H. C., New England College of Pharmacy, Boston, Massachusetts
Ray, William H., Purdue University, Lafayette, Indiana
Renaud, J. L., Medical College of South Carolina, Charlestown, South Carolina
Reed, Claude M., Albany College of Pharmacy, Albany, New York
Riedel, Mr. and Mrs. B. E., University of Alberta, Edmonton, Alberta, Canada
Riedesel, C. C., Idaho State College, Pocatello, Idaho
Reif, E. C., University of Pittsburgh, Pittsburgh, Pennsylvania
Rodman, M. J., Rutgers University, Newark New Jersey
Rogan, Mr. and Mrs. H., Wayne University, Detroit, Michigan
Rossi, Ernest, University of Connecticut, Storrs, Connecticut
Rowe, Tom D., University of Michigan, Ann Arbor, Michigan
Rowland, I. W., Idaho State College, Pocatello, Idaho

Saski, Witold, University of Nebraska, Lincoln, Nebraska
Schaefer, Mr. and Mrs. Hugo, Brooklyn College of Pharmacy, Brooklyn, New York
Schermerhorn, John W., Massachusetts College of Pharmacy, Boston, Massachusetts
Schleif, Robert, St. Louis College of Pharmacy, St. Louis, Missouri

Schlembach, R. J., University of Toledo, Toledo, Ohio
Schwarting, Mr. and Mrs. A. E., University of Connecticut, Storrs, Connecticut
Schwarz, Thomas W., University of California, San Francisco, California
Seybert, Mr. and Mrs. John E., Eli Lilly and Co., Indianapolis, Indiana
Sheffield, William J., University of Texas, Austin, Texas
Sica, A. J., Fordham University, New York City
Simmons, S. A., Q. and C. Merriam Co., New York City
Skauen, Mr. and Mrs. D. M., University of Connecticut, Storrs, Connecticut
Slama, Mr. and Mrs. Frank J., University of Maryland, Baltimore, Maryland
Smith, Mr. and Mrs. Albert C., Ohio University, Ada, Ohio
Smith, Phyllis, University of Pennsylvania, Philadelphia, Pennsylvania
Smith, Pierre F., Rutgers University, Newark, New Jersey
Smith, Willard G., University of Southern California, Los Angeles, California
Sonnedecker, Glenn, University of Wisconsin, Madison, Wisconsin
Sosinsky, Mr. and Mrs. Jack, Brooklyn College of Pharmacy, Brooklyn, New York
Sprowls, J. B., Temple University, Philadelphia, Pennsylvania
Staba, E. J., University of Connecticut, Storrs, Connecticut
Stempel, Edward, Brooklyn College of Pharmacy, Brooklyn, New York
Strother, W. D., Southwestern State College, Weatherford, Oklahoma
Swinyard, Mr. and Mrs. E. A., University of Utah, Salt Lake City, Utah
Summers, Jack L., University of Saskatchewan, Saskatoon, Canada
Sun, Peter Y., Columbia University, New York City

Thompson, Mr. and Mrs. H. O., University of North Carolina, Chapel Hill, North Carolina
Thoms, Mr. and Mrs. R. K., University of Connecticut, Storrs, Connecticut
Tice, Mr. and Mrs. Linwood, Philadelphia College of Pharmacy, Philadelphia, Pennsylvania
Tyler, Mr. and Mrs. V. E. Jr., University of Nebraska, Lincoln, Nebraska

Urdang, Arnold, University of Connecticut, Storrs, Connecticut

Vander Wyk, Raymond W., Massachusetts College of Pharmacy, Boston, Massachusetts
Van Horne, Mr. and Mrs. R. L., University of Iowa, Iowa City, Iowa
Voigt, Ralph F., University of Illinois, Chicago, Illinois

Waldon, Curtis M., Detroit Institute of Technology, Detroit, Michigan
Warawdekar, S., University of Connecticut, Storrs, Connecticut
Weaver, Mr. and Mrs. W. E., Medical College of Virginia, Richmond, Virginia
Webster, Mr. and Mrs. G. L., University of Illinois, Chicago, Illinois
Weeks, James R., Drake University, Des Moines, Iowa
West, Mrs. Jacqueline H.. Howard University, Washington, D. C.
Weston, William H., Harvard University, Boston, Massachusetts
Wiesse, Mr. and Mrs. G. A., University of Iowa, Iowa City, Iowa
Wilken, Mr. and Mrs. Leon O. Jr., University of Texas, Austin, Texas
Williams, Franklin S., University of Arkansas, Little Rock, Arkansas
Williams, Mr. and Mrs. W. R., University of Connecticut, Storrs, Connecticut
Willaman, Mr. and Mrs. J. J., U. S. Dept. of Agriculture Philadelphia, Pennsylvania
Wilson, Edwin E., Massachusetts College of Pharmacy, Boston, Massachusetts
Wilson, Ralph M., Ferris Institute, Big Rapids, Michigan
Wilson, Mr. and Mrs. Stephen, Wayne University, Detroit, Michigan
Worrell, Mr. and Mrs. Lee, University of Michigan, Ann Arbor, Michigan
Wuggatzer, Walter L., Rutgers University, Newark, New Jersey
Wurdack, John H., University of Pittsburgh, Pittsburgh, Pennsylvania

Youngken, Eugene, Bates College, Lewiston, Maine
Youngken, Heber W. Jr., University of Washington, Seattle, Washington
Youngken, Mr. and Mrs. Heber W. Sr., Massachusetts College of Pharmacy, Boston, Massachusetts

Zopf, Mr. and Mrs. Louis, University of Iowa, Iowa City, Iowa

PROGRAM

TEACHERS' SEMINAR ON PHARMACEUTICAL EDUCATION

Sunday – August 15

1:00 Registration, Dormitory 3, Section D, South Campus

7:30 Student Union Ballroom
Honorary Chairman H. S. Johnson
Presiding – H. G. Hewitt
Address of Welcome – A. N. Jorgensen, President, University of Connecticut
Greetings from the American Foundation for Pharmaceutical Education – W. Paul Briggs
Greetings from the American Association of Colleges of Pharmacy – Edward P. Reif, University of Pittsburgh
Objectives of Seminar–"What Do We Expect to Accomplish?", Lloyd E. Blauch, Chief of Education in the Health Professions, Office of Education, Dept. of Health, Education and Welfare

Monday Morning – August 16

THE TEACHER

8:00 Registration, Student Union Lobby

9:00 Student Union Ballroom
Honorary Chairman–A. H. Uhl
Presiding–L. M. Parks
"The Teacher and His Work", L. E. Blauch

9:30 Discussion

9:35 "The Learning Process", M. O. Pella, University of Wisconsin

10:05 Discussion

10:10 Intermission

10:25 "Language in Learning and Teaching", D. Durrell, Boston University

10:55 Discussion

11:00 "Nature and Function of Educational Objectives", P. Roy Brammell, University of Connecticut

11:30 Discussion

11:35 General Discussion of morning papers

Monday Afternoon – August 16

1:30 Discussion Sessions
Pharmaceutical Chemistry – Student Union, Rm. 101. Presiding, L. M. Parks
Discussion Leaders – G. E. Cwalina, P. J. Jannke, J. E. Orr and G. L. Webster
Pharmacognosy–Student Union, Room 202–Presiding, A. E. Schwarting
Discussion Leaders – E. P. Claus, R. A. Deno, L. D. Hiner and H. W. Youngken, Jr.
Pharmacology – Student Union, Room 214 – Presiding, E. A. Swinyard
Discussion Leaders – L. D. Edwards, G. C. Gross, F. T. Maher and M. J. Rodman
Pharmacy – Student Union, Room 306 – Presiding, L. C. Zopf
Discussion Leaders– D. C. Brodie, L. W. Busse, J. B. Sprowls and L. F. Tice
Pharmacy Administration – Student Union, Rm. 301 – Presiding, S. Wilson
Discussion Leaders – W. S. Apple, J. H. Goodness, P. C. Olsen and C. C. Rabe
Professional Orientation – Student Union, Room 101 – Presiding, G. Sonnedecker
Discussion Leaders – K. L. Kaufman, G. E. Osborne, T. D. Rowe and L. F. Tice

Monday Night – August 16

8:00 Professional Orientation Workshop – Student Union Ballroom

Tuesday Morning – August 17

METHODS OF CLASSROOM INSTRUCTION

9:00 Student Union Ballroom
Honorary Chairman–J. Lester Hayman
Presiding–A. E. Schwarting
"Memorizing and Rational Learning", M. O. Pella

9:35 Discussion

9:45 "The Lecture Method"; R. Billett, Boston U.

10:20 Discussion

10:30 Intermission

10:45 "Discussion, Quiz and Recitation Methods", R. Billett

11:20 Discussion

11:30 General Discussion of Morning Papers

Tuesday Afternoon – August 17

1:30 Discussion Sessions
Groups will meet as described for Monday afternoon sessions

Tuesday Night – August 17

6:30 Chicken Barbecue–Hawley Armory

8:00 Student Union Ballroom
Presiding – H. G. Hewitt
"Methods of Presenting Technical Papers", W. H. Weston, Harvard University

9:00 Open House School of Pharmacy

Wednesday Morning – August 18

METHODS OF DEMONSTRATION AND LABORATORY INSTRUCTION

9:00 Student Union Ballroom
Honorary Chairman–B. V. Christensen
Presiding–E. A. Swinyard
"Perceptual and Motor Learning", M. O. Pella

9:30 Discussion

9:35 "Purpose and Character of Laboratory Instruction", D. J. Blick, University of Connecticut

10:05 Discussion

10:10 Intermission
10:25 "Methods of Instructing and Directing Students in the Laboratory", G. L. Webster, University of Illinois
10:55 Discussion
11:00 "Laboratory–Report and Evaluation of Student Achievement", M. W. Green, American Council on Pharmaceutical Education
11:30 Discussion
11:35 General Discussion of Morning Papers

Wednesday Afternoon – August 18

1:30 Discussion Sessions
Groups will meet as described for Monday afternoon sessions

Wednesday Night – August 18

7:30 Registration Plant Science Seminar–Student Union Room 306
7:30 Session of Pharmacy Administration Group – School of Pharmacy, Room 180
8:00 Professional Orientation Workshop – Student Union Ballroom
8:15 First Session Plant Science Seminar, Student Union, Room 306

Thursday Morning – August 19

TESTING

9:00 Student Union Ballroom
Honorary Chairman–J. Allen Reese
Presiding–L. C. Zopf
"Purposes and Values of Testing", R. E. Ebel, University of Iowa
9:35 Discussion
9:45 "Essay and Short Answer Questions", R. E. Ebel
10:20 Discussion
10:30 Intermission
10:45 "Scoring and Grading Examinations", R. E. Ebel
11:20 Discussion
11:30 General Discussion of morning papers

Thursday Afternoon – August 19

1:30 Discussion Sessions
Groups will meet as described for Monday afternoon sessions
3:30 Second Session Plant Science Seminar – Tour of University Greenhouses and Gardens.
Talk, "Flower Color Genetics", by G. A. Mehlquist, University of Connecticut.

Thursday Night – August 19

7:30 Third Session Plant Science Seminar–Student Union, Room 306
8:00 Pharmacy Orientation Workshop – Student Union 101

Friday Morning – August 20

AUDIO VISUAL AIDS

9:30 Student Union Ballroom
Honorary Chairman–T. C. Daniels
Presiding–S. Wilson
"The Place of Audio Visual Materials in Pharmaceutical Education". C. W. H. Erickson, Director Audio Visual Aids Center, University of Connecticut
Demonstrations by N. W. Fenney, D. M. Skauen and R. K. Thoms of the University of Connecticut School of Pharmacy
Question and Answer Period

Friday Afternoon – August 20

1:30 Student Union Ballroom
Honorary Chairman–J. B. Burt
Presiding–H. G. Hewitt
"The Evaluation of a Teacher", R. A. Deno, University of Michigan
Summary and Review of the Seminar–"Have We Realized Our Objectives?", L. E. Blauch

Friday Night – August 20

6:30 Fourth Session Plant Science Seminar–Faculty Grill. Illustrated Talk, "Bogs, Barrens and By-Roads", by Raymond D. Wood of Mt. Kisco, N. Y.
8:30 Patio Dance–Student Union

Saturday Morning – August 21

10:00 Final Session Plant Science Seminar–Field trip conducted by R. H. Waldo, Norwich, Conn. and W. H. Camp, University of Connecticut.

WOMEN'S PROGRAM

Sunday – August 15

7:30 Opening Session of the Teachers' Seminar
Student Union Ballroom

Monday – August 16

3:00 to
5:00 Tea for Women
Hostesses–Wives of UConn Pharmacy Faculty
At home of Mrs. H. G. Hewitt, Hanks Hill Road, Storrs.

Tuesday Afternoon – August 17

2:00 Visit to the Wadsworth Atheneum, Hartford, Connecticut. This public Art Museum was founded in 1842. The tour will concentrate on the arts of New England and especially Connecticut.

Tuesday Night – August 17

6:30 Chicken Barbecue–Hawley Armory
8:00 Student Union Ballroom–Open to the public
"Methods of Presenting Technical Papers", Dr. W. H. Weston of Harvard University
9:00 Open House School of Pharmacy

Wednesday Afternoon – August 18

1:30 Dessert – Cards, if desired–Student Union Patio

Thursday – August 19

10:00 Auto Caravan to Sturbridge Village for wives and children

Friday – August 20

8:30 Patio Dance for all attending meetings – Student Union